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ABSTRACT

This material includes student guide sheets, reference materials, and tape script for the audio-tutorial unit on Inland Wetlands. A set of 35mm slides and an audio tape are used with the materials. The material is designed for use with Connecticut schools, but it can be adapted to other localities. The unit materials emphasize the structure, function, and importance of the wetlands. Activities include information on various aspects of wetlands including food chains, cycles, organisms, and ecological areas. (RH)

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COASTAL WETLANDS

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GUIDE SHEET #1

In recent years we have heard members of numerous organizations express a deep concern for the destruction of our coastal wetlands. Much of the reason for the destruction of coastal wetlands stems from a lack of understanding of the vital role these areas play in a variety of food webs and the hydrological cycle. This unit is designed to introduce you to the structure, function and importance of this severly threatened resource.

More specifically, this unit is designed to:

1. Introduce you to the role coastal wetlands play in numerous food webs and the hydrologic cycle.
2. Compare and contrast the coastal wetland areas classified as estuaries, estuarine marsh, salt marsh and tidal marsh.
3. Describe the process of marsh formation.
4. Discuss the role of salinity and flooding in the development of coastal wetland plant zonation.
5. Outline the flow of nutrients in a coastal wetland ecosystem.
6. Outline the flow of energy in a coastal wetland ecosystem.
7. Describe important ecological principles which will prove useful in making coastal wetland management decisions.
8. Describe the impact of human activity on coastal wetlands.

After you have studied the objective for this unit, place slide number #1 in you slide viewer and start the recorder.

BE A RECYCLER YOURSELF. WRITE YOUR COMMENTS, NOTES, AND ANSWERS ON SCRAP PAPER INSTEAD OF THESE GUIDE SHEETS. IN THIS WAY, THESE GUIDE SHEETS WILL BE AVAILABLE FOR THE NEXT PERSON IN YOUR COMMUNITY WHO WILL BE MAKING USE OF THIS UNIT.

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GUIDE SHEET # 2

COASTAL RESOURCES

A. Four key terms well worth knowing.

1. Estuary--any confined coastal water body with an open connection to the sea and a measurable quantity of salt in its water(brackish).

2. Estuarine Marsh--a marsh in an estuary. The water in the marsh is brackish.

3. Tidal marsh--a marsh whose water level is influenced by the tides. A tidal marsh can be fresh water or brackish.

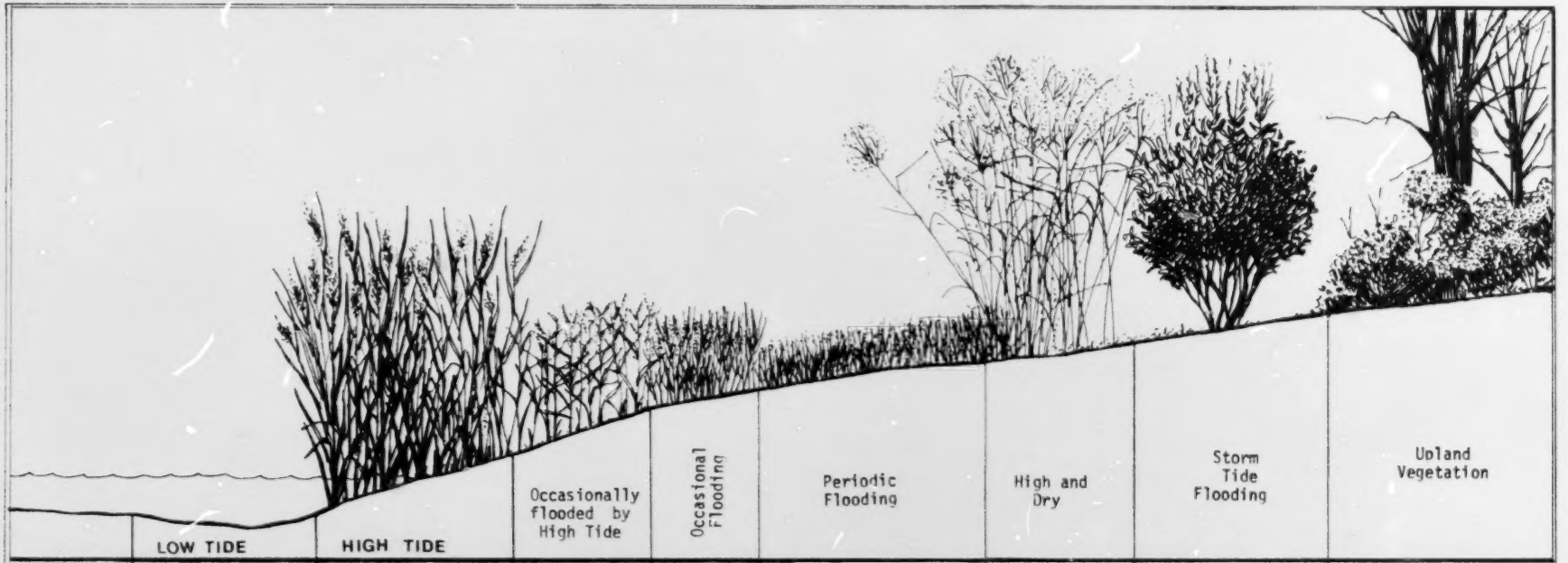
4. Salt water marsh--a marsh with water from a sound, bay, sea or ocean.

B. Diagram showing the relationship among an estuary, estuarine marsh, tidal marsh and salt water marsh.

C. Salinity ranges of specific coastal wetland areas.

Type	Salinity Range (ppt-parts per thousand)
Salt water marsh	35 ppt
Estuarine marsh(tidal marsh)	0.5 ppt to 34 ppt
Fresh water tidal marsh	0 ppt

GUIDE SHEET No. 3 CROSS SECTION OF A SALT MARSH



ZONE NUMBER	1	2	3	4	5	6	7	8
COMMON NAME	Mud Flats at Low Tide	SMOOTH CORD GRASS	SALT MEADOW GRASS	SPIKE GRASS	BLACK GRASS	SWITCH GRASS	MARSH ELDER	SHRUBS and TREES
SCIENTIFIC NAME		Spartina alterniflora	Spartina patens	Distichlis spicta	Juncus gerardi	Panicum virgatum	Iva fructescens	

LOW TIDE LEVEL

HIGH TIDE LEVEL

STORM TIDE LEVEL

GUIDE SHEET No.4

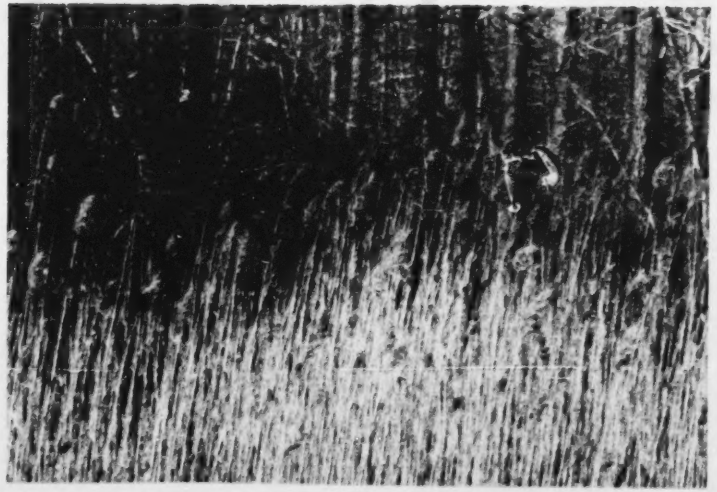
SALT MARSH VEGETATION ZONES

SWITCH GRASS

GLASSWORT

SMOOTH
CORD GRASS

SALT MEADOW
GRASS



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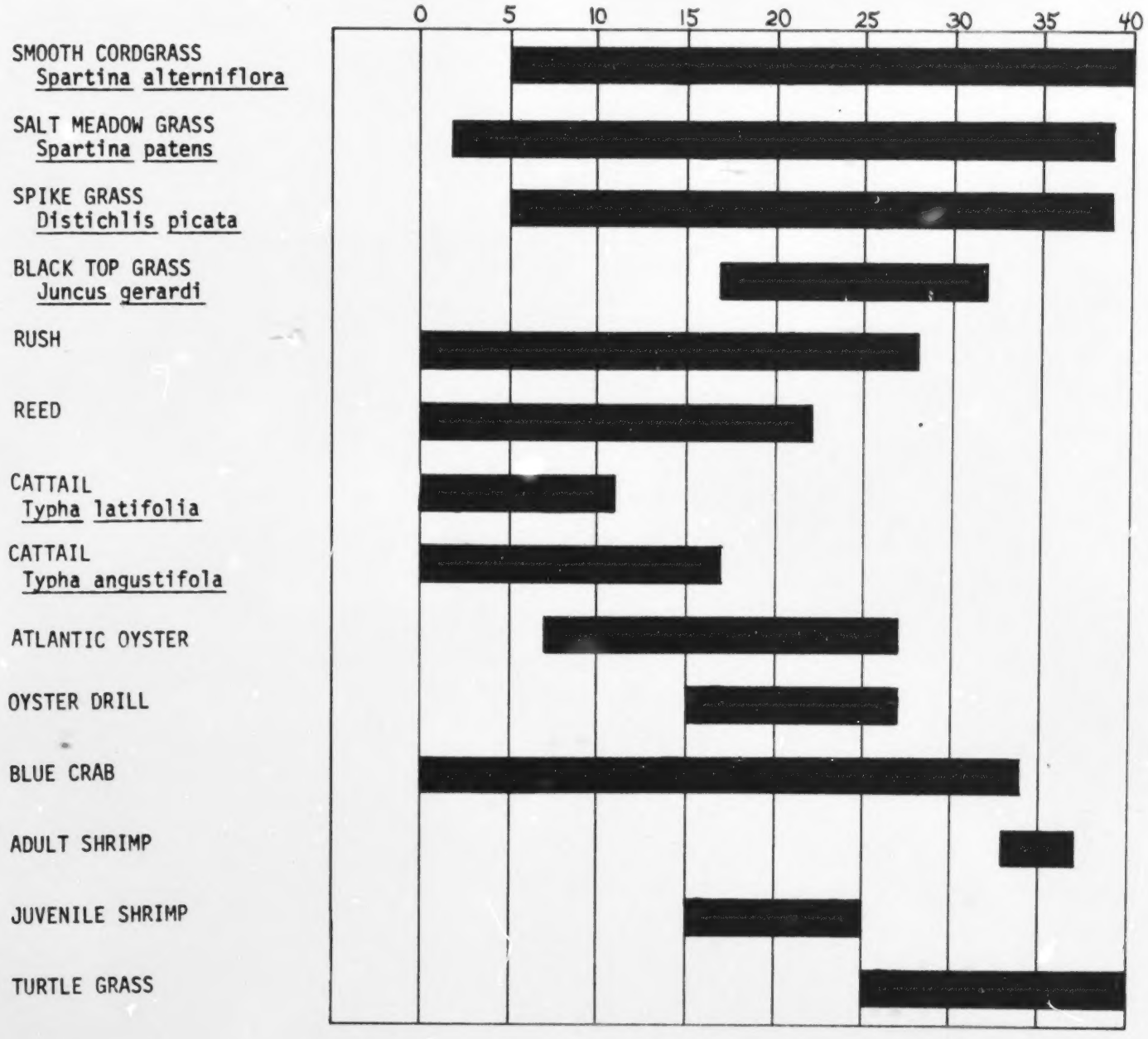
GUIDE SHEET No. 5

SALINITY TOLERANCE OF FLORA AND FAUNA



Source:
1. "What's Happening to Our Salt Marshes," by John J. Spagnoli, Conservationist, April-May, 1971.
2. Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone by John Clark, Conservation Foundation, 1974.

Guide Sheet #6

LIST OF ECOLOGICAL PRINCIPLES

It will be useful for later discussions to keep a record of ecological principles as we describe them. We have given you a start by writing in principle 1.

1. Natural fluctuations in salinity provide for optimum coastal wetlands ecosystem function.

2.

3.

4.

5.

6.

7.

8.

9.

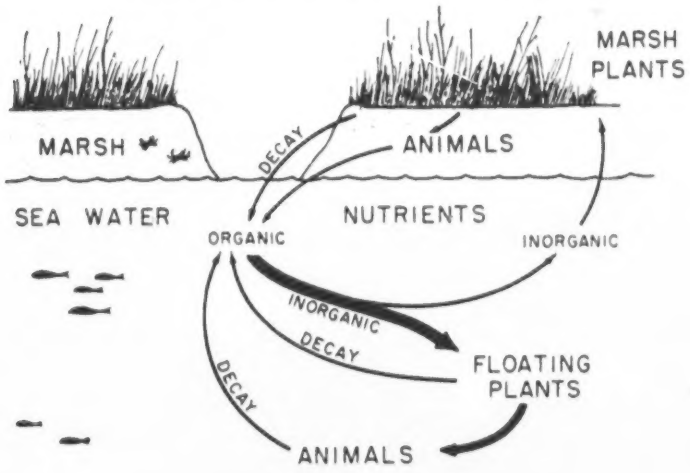
10.

11.

GUIDE SHEET #7

FOOD CHAINS OF COASTAL COMMUNITIES

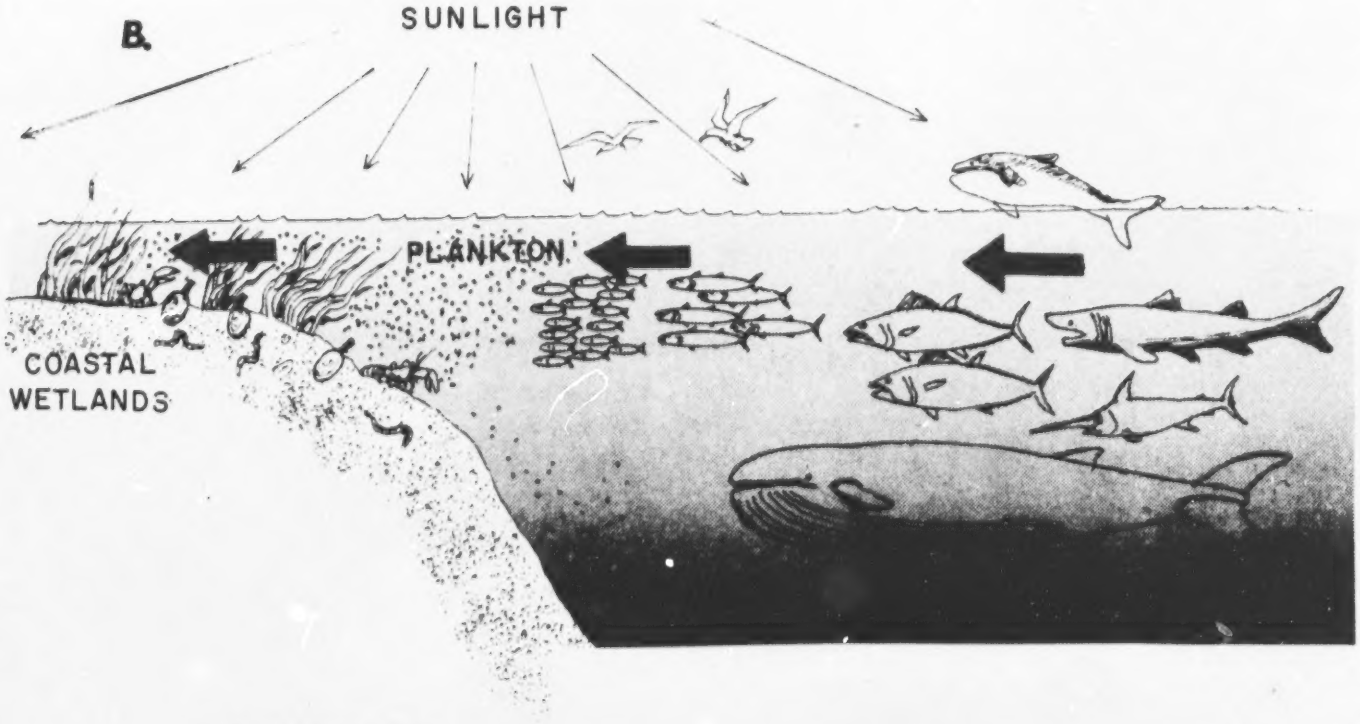
A.



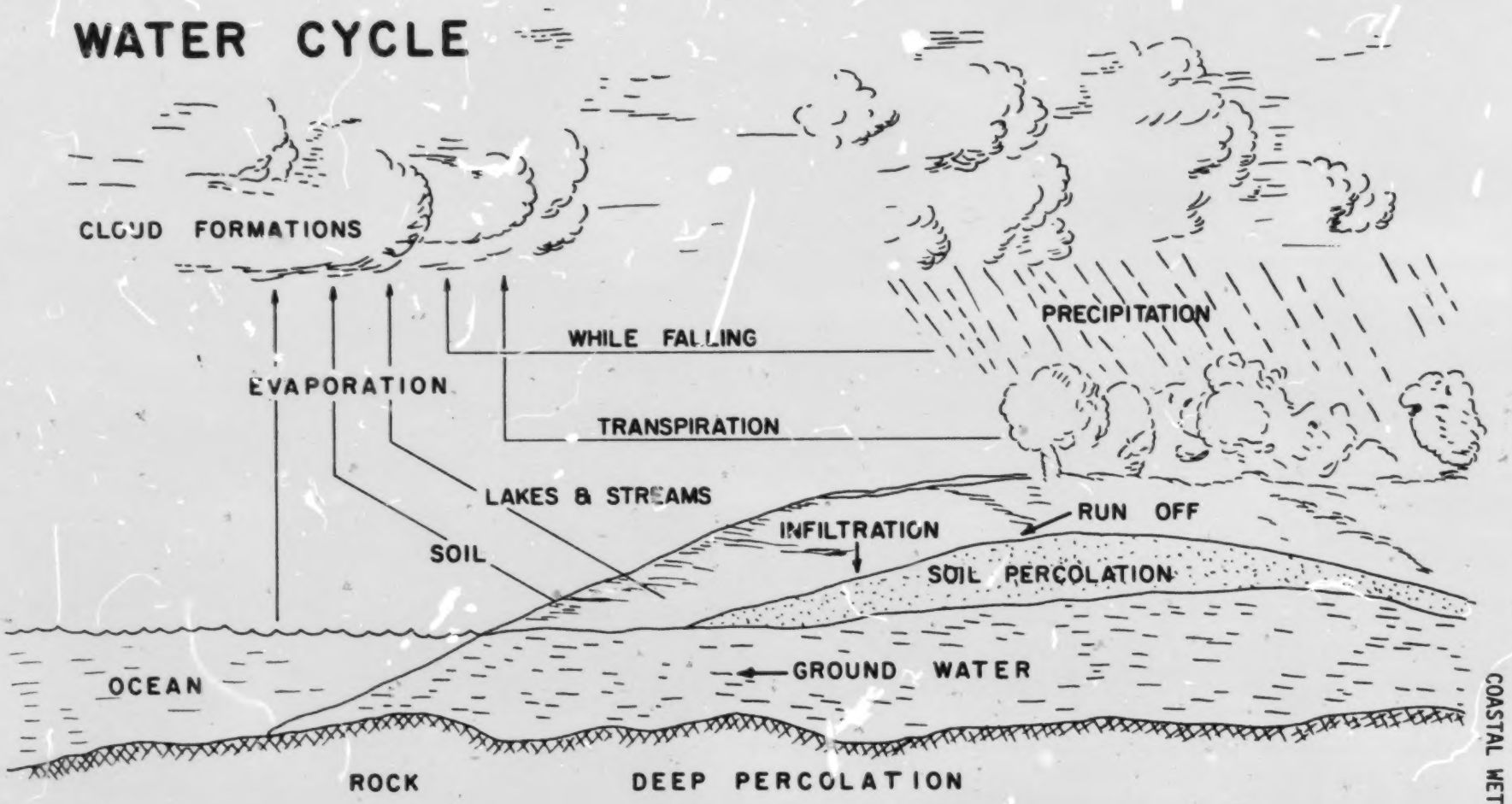
The exchanges of nutrients between tidemarshes and the tidal waters. The width of the arrows represents the relative amounts of the nutrients. (Reprinted from an article by F. A. Kalber, Jr. in the *Delaware Conservationist*, Summer 1959.)

Source: Connecticut's Coastal Marshes: A Vanishing Resource. Connecticut Arboretum Bulletin, No. 12.

B.



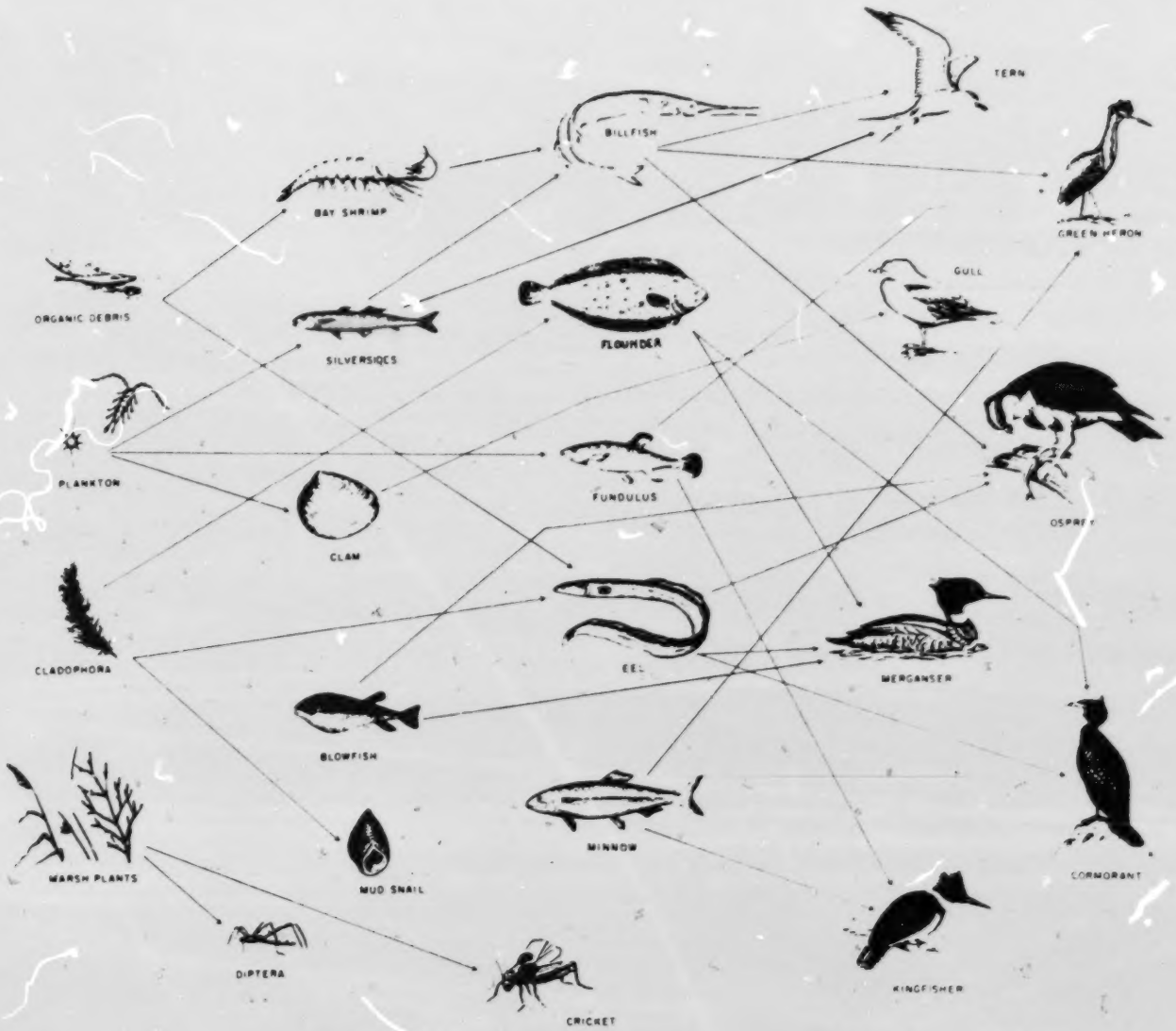
MARINE FOOD CHAIN



GUIDE SHEET #8 HYDROLOGIC CYCLE

Source: Statewide Long-Range Plan for The Management of The Water Resources of Connecticut, Phase I, 1971.

GUIDE SHEET #9



SALT MARSH AND BAY

Dennis Puleston
Environmental Defense Fund

Illustrative food web pathways in a wetlands environment. Many other pathways exist, both on and off this figure, but they are omitted for clarity of presentation. For example, mergansers also eat silversides although this simplified diagram does not so depict.

3

Source: "Ecological Studies," Long Island Sound Regional Study. February, 1974.

GUIDE SHEET #10

Part A. Productivity of the Ocean, Coastal Zone, Coastal Wetlands and Estuaries

Zone	% of Ocean	Annual Fish Production /Metric Tons	% of Fish Catch
Ocean zone	90	160,000	.06%
Coastal zone	9.0	120,000,000	49.96%
Coastal wetlands and estuaries	0.1	120,000,000	49.96%

Source: "Photosynthesis and Fish Production in the Sea," by John Ryther, Science 166, 72 (1969).

Part B. Nutrient Flow in Coastal Wetlands

"Fertilizing nutrients are absorbed in the mud and are present in sufficinet reserve to last for 500 years without renewal. Renewal, however, is going on continuously. Grasses remove nutrients for the mud, down to a depth of several feet, but nutrients are reabsorbed into the mud again as water percolates through burrows and cracks. The standing stock of grass, both living and dead, contains a large reserve of nutrients, in the sense of fertilizer, and potential foodstuff for everything from bacteria to large fishes. Because the grass decomposes slowly throughout the year, there is a constant and quite even supply of materials. The result is a productive and stable ecosystem."

Source: Frankenberg, et.al. "Coastal Ecology of Recreational Development," In The Georgia Coast: Issues and ontions for Recreation, The Conservation Foundation, 1971.

GUIDE SHEET #11

LIST OF ECOLOGICAL PRINCIPLES*

1. SALINITY - The natural salinity regime provides for optimum ecosystem function.

2. LINKAGE - Water provides the essential linkage of land and sea elements of the coastal ecosystem.

3. INFLOW - The natural volume, pattern, and seasonal rate of fresh water inflow provides for optimum ecosystem function.

4. BASIN CIRCULATION - the natural pattern of water circulation within basins provides for optimum ecosystem function.

5. LIGHT - The natural light regime provides for optimum ecosystem function.

6. TEMPERATURES - The natural temperature regime provides for optimum ecosystem function.

7. OXYGEN - High concentrations of dissolved oxygen provide for optimum ecosystem function.

8. NITROGEN - Productivity in coastal waters is normally governed by the amount of available nitrogen.

9. ENERGY - The flow and amount of available energy governs life processes within the coastal ecosystem.

10. STORAGE - A high capability for energy storage provides for optimum ecosystem function.

11. ECOSYSTEM INTEGRITY - No one part of an ecosystem operates independently of any other.

The eleven principles listed above are derived from ecology. They underlie some major management functions to be discussed in COASTAL WETLANDS II.

Source: Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone by John Clark. Conservation Foundation, Washington, D.C., 1974.

GUIDE SHEET #12

WILDLIFE OF OUR COASTAL MARSHES AND ESTUARIES.

Birds - At least 100 species.

Name 4 1._____

2._____

3._____

4._____

Mammals - At least 20 species.

Name 2 1._____

2._____

Fish - At least 25 species.

Name 2 1._____

2._____

Mollusks (shellfish) - At least 10 species.

Name 2 1._____

2._____

Insects - At least 30 species.

Name 2 1._____

2._____

Amphibians - At least 10 species.

Name 1 1._____

Crustacea (shellfish) - 10 species.

Name 1 1._____

Reptiles - At least 15 species.

Name 2 1._____

2._____

(Switch recorder back on)

GUIDE SHEET #13

PARTIAL LIST OF COMMON WILDLIFE FOUND IN OR AROUND CONNECTICUT'S COASTAL MARSHES.

Birds

Herring Gull
Great Black-backed Gull
Crow
Kingfisher
Downey Woodpecker
Canada Goose
Whistling Swan
Black Duck
Scoter
Robin
Seaside Sparrow
Owl
Marsh Hawk
Heron
Egret
Rail
Tern

Mammals

Opposum
Shrew
Mole
Muskrat
White footed mouse
Deer
Fox
Raccoon
Skunk
Squirrel
Mice
Humans

Insects

Mosquito
Fly (biting flies)
Bumblebee
Flea
Tick
Spider
Monarch Butterfly
Ants
Ladybug

Fish

Shad
Striped Bass
Bunkers (Aleurife)
Sea Robin
Blue fish
Carp
Eel
Crappie
Stickleback
Pipe fish

Mollusks

Clams
Oysters
Mussels
Scallops
Snails

Amphibians

Newt
Red-backed salamander
Spring peeper
Bullfrog
Leopard Frog
Toad

Crustacea

Crabs
Shrimp
Barnacles

Reptiles

Garter snake
Ring necked snake
Green snake
Wood turtle
Spotted turtle
Diamondback Terrapin
Box turtle
Snapping turtle

(Switch recorder back on)

In Part 1 of this unit, attention was given to describing the role of coastal wetlands in a variety of food webs and the hydrological cycle. This section, Part II, will focus upon man's impact on coastal wetlands. The unit will describe the impact that alternative development activities have had on these important ecosystems. Major laws that govern activities in coastal wetlands will be described, and some management recommendations will be advanced.

More specifically, this unit is designed to:

1. Describe the impact that man and his activities have had upon coastal wetlands from colonial days to the present time.
2. Compare the location of Connecticut's coastal wetlands to the location of intensively developed urban areas on the Connecituct coastline.
3. Compare and contrast the costs of developing (altering) coastal wetlands with the benefits of leaving them in an undisturbed state.
4. Identify coastal regions designated as vital areas, areas of environmental concern and areas of normal concern or utilization areas.
5. Describe the objectives of Connecticut's Act Concerning the Preservation of Coastal Wetlands (Public Act 695).
6. Outline the problems and issues that relate to the implementation of Public Act 695.
7. Describe major federal laws that effect activities in the coastal zone.
8. Present information on court tests of the right of the state to enforce coastal zone management regulations.
9. Involve you in activities which assess the impact of alternative uses upon the ability of coastal wetlands to perform the normal functions.
10. Propose a set of management principles and rules which can be utilized in making land use decisions in the coastal zone.

Now that you have read the objectives for this unit, turn on the recorder.

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GUIDE SHEET # 2

A. Results of an inventory of Connecticut's coastal marshes conducted in 1965. *

Connecticut coastal marshes after glacier retreat...approximately 40,000 acres

Connecticut's coastal marshes in 1914..... 23,360 acres

Marshes in Connecticut 1968..... 11,544 acres

B. Coastal Wetland acreage lost 1955 - 1965. 2,179 acres

Causes of this 10 year loss

Private Sector	% of total lost	number of acres lost
Miscellaneous filling	48%	1046
Industry	7%	152
Marinas	6%	131
Housing	5%	109
Public Sector		
Waste disposal (dumps)	14%	305
Roads and Parking	9%	196
Airports	7%	152
Recreation	3%	66
Schools	1%	22

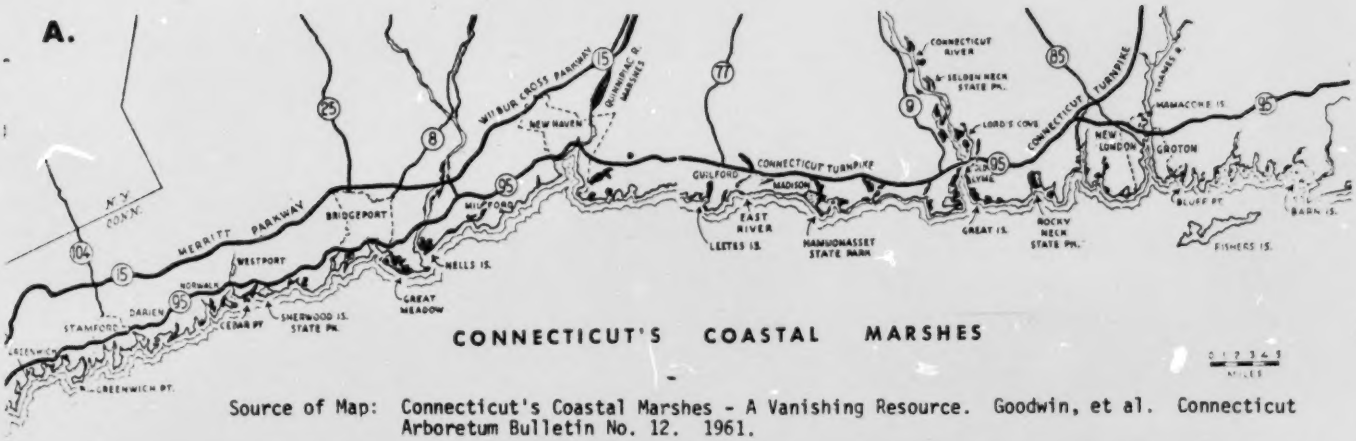
C. Losses of marshland, based on 1954 acreage, by county:

County	Acres	% of counties marsh lost	Population of county (1960)
Fairfield	923	45	653,589
New Haven	888	13	660,315
Middlesex	263	6	88,865
New London	95	3	185,745

* Goodwin et al., 1961. Connecticut's Coastal Marshes A Vanishing Resource. Connecticut Arboretum Bull. No. 12, 1961, Second Printing with supplement, 1966.

GUIDE SHEET # 3

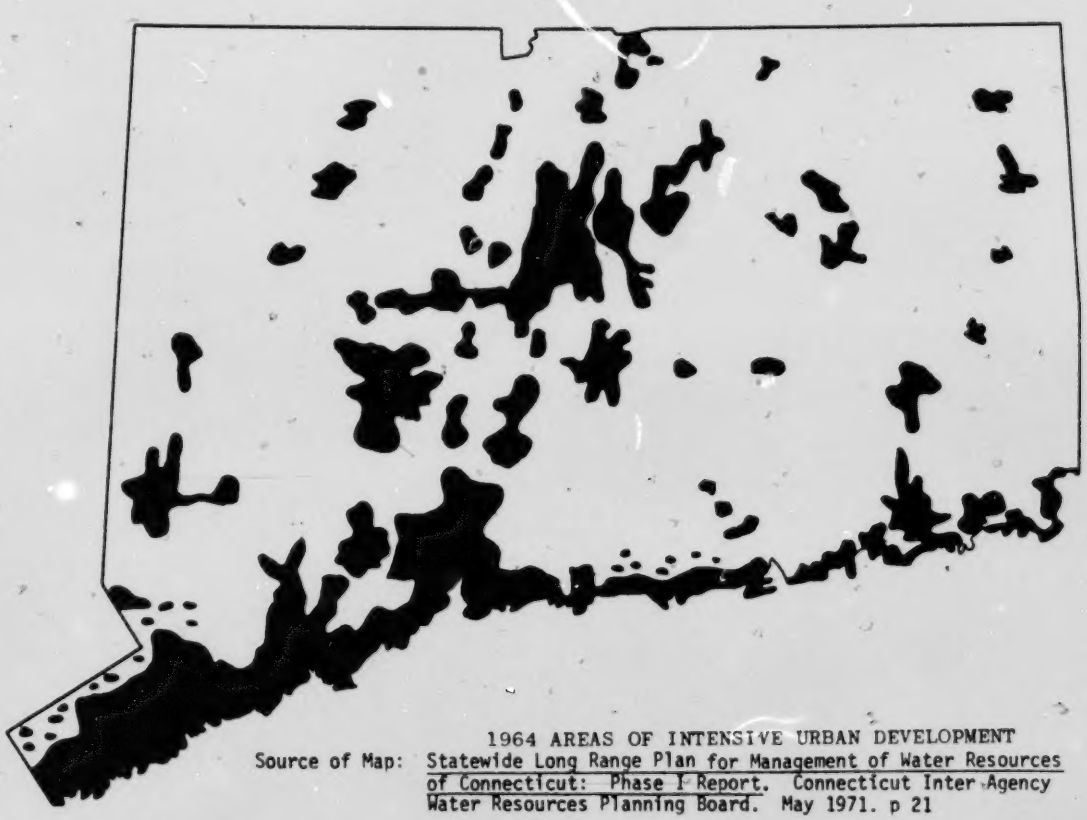
A.



CONNECTICUT'S COASTAL MARSHES

Source of Map: Connecticut's Coastal Marshes - A Vanishing Resource. Goodwin, et al. Connecticut Arboretum Bulletin No. 12. 1961.

B.



1964 AREAS OF INTENSIVE URBAN DEVELOPMENT

Source of Map: Statewide Long Range Plan for Management of Water Resources of Connecticut: Phase I Report. Connecticut Inter Agency Water Resources Planning Board. May 1971. p 21

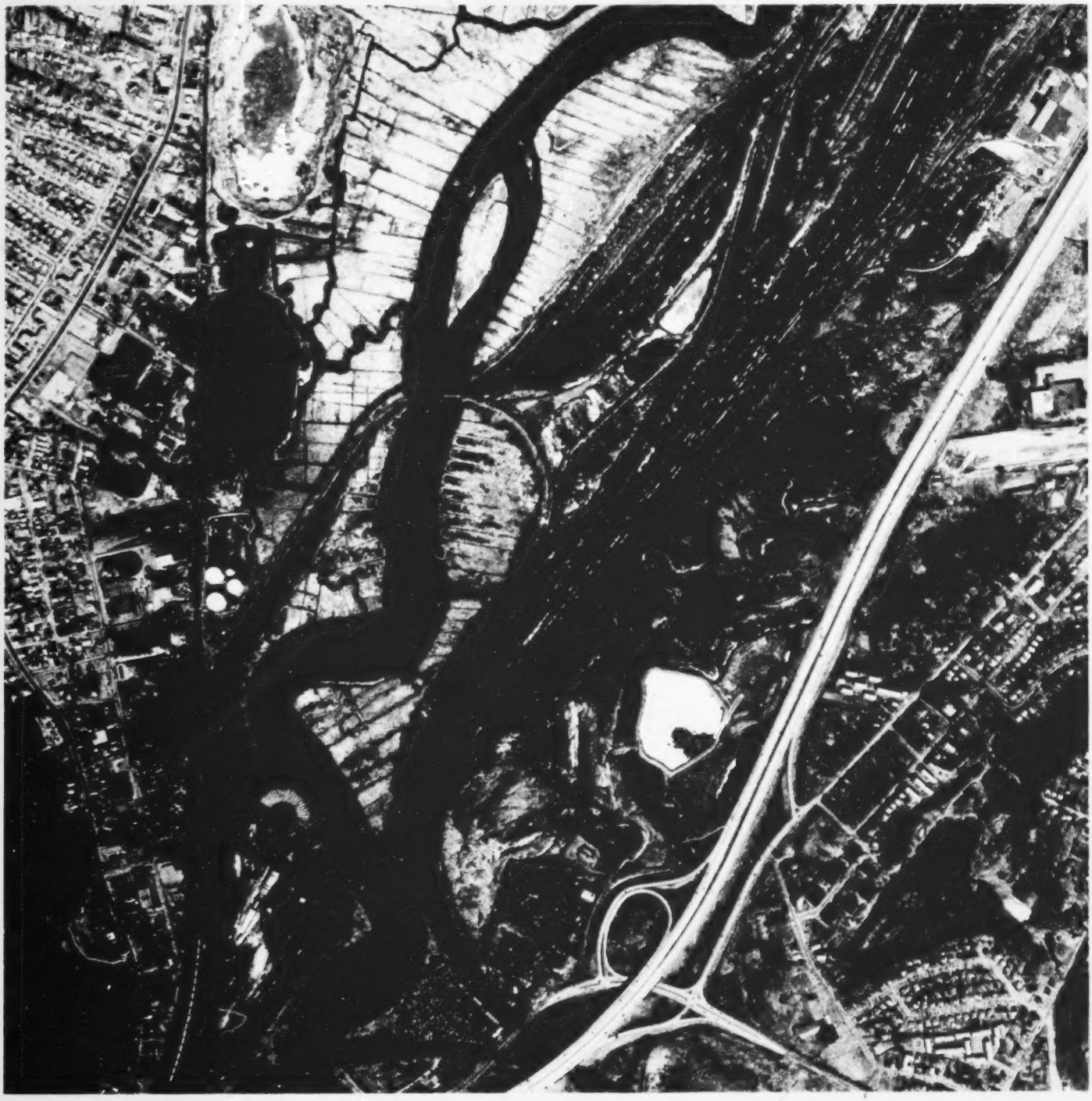
When you have finished the activity using maps A and B, turn the tape recorder back on!

C. C. Estimated Mileage of Recreation - Type Shoreline in Connecticut

Type	Miles	Ownership	Miles
Beach	72 mi.	Public	
Bluff	61 mi.	Recreation	9 mi.
Marsh	29 mi.	Restricted	---mi.
		Privately owned	153 mi.
Total	162 mi.		

Source: Report 4, Outdoor Recreation Resources Review Commission, 1962.

GUIDE SHEET NO. 4



GUIDE SHEET # 5

TASK TO BE USED WITH THE AERIAL PHOTOGRAPH ON GUIDE SHEET #4

A. Study the aerial photograph on guide sheet #4 and check off each of the items on the list which you locate:

___ Four Lane Highway
___ Railroad Roundhouse
___ Mosquito Ditches
___ Highway Interchange
___ Railroad bridges
___ Railroad tracks
___ Oil storage tanks
___ Junk yards
___ Industrial Complexes
___ Regional Incinerator
___ Land fill operation
___ Old clay pits
___ Residential housing
___ Residential roads

* Activity: Select a few of the items from the list in section A of this guide sheet and write them at the top of the matrix...then procede down the question list and answer yes or no for each one.

Has the activity	Constructing four lane highway	Building of railroad track			
1. ...altered any drainageway by realignment, bulkheading, filling or impounding?					
2. ...caused any significant change in the natural rate of water flow in the tidal wetland?					
3. ...reduced the natural supply of nutrients in the coastal ecosystem by altering the freshwater inflow?					
4. ...been responsible for discharge into the confined tidal marsh waters?					
5. ...caused turbidity in the water of the tidal marsh area to be higher than natural levels?					
6. ...significantly altered the natural temperature fluctuations of the tidal marsh and its water?					
7. ...reduced the concentration of oxygen below the natural level before development?					
8. ...significantly affected the salinity levels of the marsh waters?					
9. ...been responsible for the discharge of suspended nutrients, solids or toxic chemicals?					

When you have finished using the checklist on at least two items from the list in section A, turn the recorder back on!

GUIDE SHEET # 5

(continued)

B. The following management rules have been developed by John Clark*of the Conservation Foundation and are based upon the ecological principals outlined in part I of the Coastal Wetland A-T Unit. Read through the list carefully!

1. Drainageways: Alteration of any drainageway by realignment, bulkheading, filling, impounding, or any other process that shortcuts the natural rate or pattern of flow or blocks or impedes its passage is unacceptable.

2. Basin circulation: Any significant change from the natural rate of water flows of a coastal water basin is presumed to be ecologically detrimental and is unacceptable.

3. Nutrient supply: Reduction of the natural supply of nutrients to the coastal ecosystem by alteration of fresh water inflow is unacceptable.

4. Nitrogen: Discharge of nitrogenous compounds into confined coastal waters is presumed to have adverse effects through eutrophication and is unacceptable.

5. Turbidity: Turbidity of higher than natural levels is to be presumed detrimental to the coastal ecosystem and is unacceptable.

6. Temperature: Significant alteration of the natural temperature regime of the coastal ecosystem is presumed adverse and is unacceptable.

7. Oxygen: Any significant reduction from the natural concentration of oxygen is presumed to be adverse and is unacceptable.

8. Salinity: Any significant change from the natural salinity regime is presumed ecologically detrimental and is unacceptable.

9. Runoff contamination: Any significant discharge of suspended solids, nutrients, or toxic chemicals is to be presumed and is unacceptable.

AFTER READING PART B OF THIS GUIDE SHEET, RETURN TO THE ACTIVITY ON THE OPPOSITE SIDE OF THIS PAGE.

*Source: Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone by John Clark. Conservation Foundation, Washington, D.C., 1974.

GUIDE SHEET # 6

PUBLIC ACT 695 - WHAT IT MEANS TO CONNECTICUT*

Values of Wetlands

Common Definitions:

1. Fine places to dump anything you would like to get rid of.
2. When filled, they can be used for home or cottage sites, shopping centers, or industrial parks.
3. They can be dredged to develop marinas or access to inland docking facilities.

Uncommon Definitions:

1. Marshlands are spawning and nursery grounds for game fish.
2. They produce abundant marine life that is the beginning of the food chain on which a thriving marine fishery often depends.
3. Tidal wetlands provide a breeding and nesting area for many kinds of waterfowl.
4. They are also the breeding grounds for many other birds, animals and crustacea.
5. They provide an unusually beautiful and integral part of shore scenery. Unfortunately, they are not missed until they have been entirely eliminated.
6. They provide a buffer zone against violent storms and high tides, and they act like a sponge to soak up and retain flood waters from whatever source.

Connecticut is now embarking on a program to regulate the use of our tidal wetlands to prevent their indiscriminate destruction so that those tidal wetlands will be used for the benefit of all.

*Source: Connecticut's Program to Save its Wetlands

GUIDE SHEET # 7

PUBLIC ACT 695

AN ACT CONCERNING THE PR[illegible]VATION OF WETLANDS AND TIDAL MARSH AND ESTUARINE SYSTEMS.

This Act is to be administered by the Department of Environmental Protection through the Office of the Commissioner. The effective date of the Act is October 1, 1969.

Public Act 695 has strong similarities to the stream channel encroachment program in which the Water Resources Commission establishes boundaries of flood-prone acres along waterways within which no obstruction or encroachment shall be constructed without a permit. The Act also resembles local zoning regulations in some respects.

A SUMMARY OF THE PROVISIONS OF PUBLIC ACT 695

It includes a definition of wetlands based primarily on a description of the flora indigenous to typical marshland areas and an elevation of one foot above local extreme high water. It includes a definition of regulated activities such as dredging and filling of wetlands.

Section 2 is a statement of purpose in which the importance of retaining wetlands is set forth.

Section 3 calls upon the Commissioner of Environmental Protection to make an inventory of the tidal wetlands of the State; to show them on boundary maps; to hold public hearings on each subdivision; and to establish the bounds of each wetland area by order.

Section 5 of the Act states that no regulated activity shall be conducted upon any wetland without a permit.

Subsequent sections of the Act deal with the mechanics of making application for permits for conducting regulated activities on wetlands; the holding of public hearings thereon; the granting, denying or limiting of such permits; bond requirements; suspension or revocation of permits; appeals from decisions of the Commissioner to the Superior Court and alternatives in case that the appeal is upheld.

With Public Act 695 it is the intent of the Department of Environmental Protection to preserve the tidal wetlands and to regualte any development of these wetlands, as future pressures may demand, so that all the public may enjoy the benefits that these wetlands can provide.

When you have completed your study of this guide sheet, turn the recorder back on!

GUIDE SHEET # 8

DEFINITION OF WETLANDS AND TIDAL MARSH IN CONNECTICUT PUBLIC ACT 695

The Wetlands Act clearly defined what was to be surveyed and included the State in its section dealing with the definition of terms:

> "...wetlands means those areas which border on or lie beneath tidal waters, such as but not limited to, banks, bogs, salt marsh, swamps, meadows, flats, or other low lands subject to tidal action, and whose surface is at or below an elevation of one foot above local extreme high water; and upon which may grow, or be capable of growing, some, but not necessarily all, of the following..."

The Act goes on to list those species of higher plants which form the dominant vegetation of salt marshes. Clearly, this Act was meant to protect salt marshes only, despite its rather general title:

Typha latifolia L. - Cattail

T. angustifolia L. - Cattail

Distichlis spicta (L.) greene - Spike grass

Agrostis alba L. var. Palustris (Huds.) Pers. - Carpet bent

Spartina pectinata Link - Cord Grass

S. alterniflora Loisel. - Salt-water cord grass

S. patens (Ait.) Muhl - Salt meadow grass

Eleocharis rostellata Torr. - spike rush

Scirpus americanus Pers. - Saltmarsh bulrush

S. robustus Pursh. - Saltmarsh bulrush

S. paludosus Nels. var. atlanticus Fern.

Panicum virgatum - switch grass

Hierocholoe ordorata - sweet grass

Juncus gerardi Loisel. - Black grass

Salicornia Bigelovii Torr. - Glasswort

S. europaea L. - Glasswort

Spergularia marina (L.) Griseb. - Sand-spurrey

Limonium carolinianum (Walt.) Britt. - Sea-Lavender

Iva frutescens L. var. oraria (Bartl.) Fern. & Grisc. - High tide bush

As amended definition of wetlands was passed by the Connecticut Legislature in 1972, including some additional plant species for the purposes of including all of those tidal areas which supported none of the plants of the first definition.

FRESH TO BRACKISH WATER INDICATOR SPECIES OF VASCULAR PLANTS, ADDED TO PUBLIC ACT 695 AS PUBLIC ACT 132 (1972)

Osmunda regalis L. - Royal fern
O. claytoniana L. - Interrupted fern
O. cinnamomea L. - Cinnamon fern
Onoclea sensibilis L. - Sensitive fern
Dryopteris thelypteris (L.) Gray - Marsh fern
Sparganium eurycarpum Engelm. - Bur-reed
Sparganium androcladum Morong - Bur-reed
S. americanum Nutt. - Bur-reed
S. chlorocarpum Rydb. - Bur-reed
S. angustifolium Michx. - Bur-reed
S. fluctuans (Morong) Robins. - Bur-reed
S. minimum (Hartm.) Fries - Bur-reed
Zannichellia palustris L. - Horned pondweed
Alisma subcordatum Raf. - Water-plantain
Sagittaria subulata (L.) Buchenau - Arrowhead
S. graminea Michx. - Arrowhead
S. eatoni J. G. Sm. - Arrowhead
S. engelmanniana J. G. Sm. - Arrowhead
S. latifolia Willd. - Tuckahoe
Zizania aquatica L. - Wild rice
Peltandra virginica (L.) Schott & Endl. - Arrow-arum
Calla palustris L. - Water-arum
Symplocarpus foetidus Salisb. - Skunk cabbage
Acorus calamus L. - Sweet flag
Pontederia cordata L. - Pickerel weed
Heteranthere dubia (jacq.) MacM. - Water stargrass
Juncus effusus L. - Soft rush
Veratrum viride Ait. - False hellebore
Iris prismatica Pursh - Slender blue flag
I. versicolor L. - Blue flag
I. pseudacorus L. - Yellow flag
Saurrurus cernuus L. - Lizard's tail
Alnus rugosa (DuRoi) Spreng. - Speckled alder
A. serrulata (Ait.) Willd. - Common alder
Polygonum sagittatum L. - Arrow-leaved tear thumb
P. arifolium L. - Halberd-leaved tear thumb
Nuphar variegatum Engelm. - Spatter dock
Nuphar advena (Ait.) Ait. f. - Spatter dock
Caltha Palustris L. - Marsh marigold
Rosa palustris Marsh - Swamp rose
Lythrum alatum Pursh - Loosestrife
L. salicaria L. - Loosestrife
Cornus stolonifera Michx. - Red osier
C. amomum Mill. - Red willow
C. obliqua Raf. - Silky dogwood
Clethra alnifolia L. - Sweet pepper-bush
Rhododendron viscosum (L.) Torr. - Swamp azalea
Vaccinium corymbosum L. - Blueberry
V. macrocarpon Ait. - Cranberry
Cephalanthus occidentalis L. - Buttombush
Mikania scandens (L.) Willd. - Climbing hemp-weed
Eupatorium purpureum L. - Joe-pye weed
E. maculatum L. - Joe-pye weed
E. perfoliatum L. - Thoroughwort

Volume 2 Number 7 April 1975

DEP citizens' bulletin

The Brecciaroli case

State Supreme Court decision supports wetlands regulation

One of the most controversial legal issues relating to Connecticut's tidal and inland wetlands laws has been the argument that wetlands regulation violates constitutional guarantees against the "taking of private property for public use without just compensation."

In an important decision that has been awaited since passage of the wetland laws, the Connecticut Supreme Court ruled that denial of a specific use of a wetland does not violate this constitutional concept.

The ruling, which was made on April 15, concerned the denial of an application by Dante J. Brecciaroli to place fill on 5.3 acres of tidal wetlands on the East River in Guilford. Mr. Brecciaroli had received local approval for an industrial development on a site which included the state-regulated wetlands. His application for a wetlands permit was denied after a hearing in March of 1972.

Edward Daly, chief of DEP's Tidal Wetlands Preservation Program, said the application was denied on the grounds that 5.3 acres of wetlands would be destroyed, that the fill would decrease the capacity of the Guilford-Madison marsh complex to absorb flood waters, and that the applicant had failed to submit a hydrologic study that considered the possibility that the placement of fill could worsen flooding on adjacent property.

Brian O'Neill, the assistant attorney general who presented the state's case before the court, explained that the appeal was significant in that it was "a case of first impression," meaning that "it was the first time the supreme court has had to wrestle with these particular issues." The court's ruling has therefore "established a precedent that will be binding to all lower courts. Even if a lower court judge disagrees, he will have to abide by the supreme court's ruling."

DEP Commissioner Joseph N. Gill called the court's action "an historic decision which culminates several years of effort beginning with the establishment of the tidal wetlands preservation program." Commissioner Gill implemented the program on October 1, 1969.

In the Brecciaroli decision, the court quoted the Tidal Wetlands Act saying that it is "the public policy of this state to preserve the wetlands and to prevent the despoliation and destruction thereof."

"That declaration of policy," the court continued, "which has not been challenged by the plaintiff, finds extensive support in recent case law and commentary both with respect to the importance of wetlands as natural resources and with respect to their imminent demise at the hands of man."

The decision acknowledged that the privileges enjoyed by private property owners must be limited "where uncontrolled use would be harmful to the public interest," and that police power to this purpose "will not necessarily be deemed a 'taking' in the constitutional sense."

"There can be no question that the plaintiff's wetland would have greater value to him if it were filled," the court said. However, the public interest was determined to be an overriding issue: "The financial effect on a particular owner must be balanced against the health, safety and welfare of the community."

Mr. Brecciaroli appealed to the Court of Common Pleas, arguing that "denial of his application was improper and arbitrary that it was not supported by the evidence presented at the hearing; that it was an unreasonable exercise of the police power; and that it amounted to an unconstitutional taking of the plaintiff's land without compensation." His motion to introduce evidence on the taking issue was denied, and the court ruled in favor of the state. For those reasons, Mr. Brecciaroli appealed to the Supreme Court.

The key argument presented by the state, with which the court agreed, was that "the denial of the application merely prohibited one specific use which presumably was not reasonable when balanced against the public harm it would create. The plaintiff may still be permitted on subsequent application to fill a lesser portion of his wetland...he may make application for a permit or permits to conduct other regulated activities on the wetland; and he may make any reasonable unregulated use of his land consistent with the laws of the state and the zoning regulations of the town of Guilford. 'Until it appears that the plaintiff has been finally deprived...of the reasonable and proper use of the property, it cannot be said that there has been an unconstitutional taking of the property without just compensation.'"

Source: DEP CITIZENS' BULLETIN Vol. 2 No. 5 May 1975

GUIDE SHEET # 10

A. Long Range Cost of Developing Wetlands*

1. Flooding in coastal wetlands often occurs as a result of a set of conditions including the superposition of abnormally high tides, storm surge, seasonal storms, and hurricanes. Such flooding causes a high level of erosion of the exposed faces of land. If the marsh is filled, it will be necessary to install protective strucutures to alleviate this problem, but the structures themselves often cause additional problems elsewhere. In addition, maintenance of roads and utility lines through areas that are subject to flooding is quite often a continuous procedure, especially during the fall and winter seasons.

2. Soil conditions in marsh areas necessitate the use of filled areas for the placement of septic systems and the attendant leaching fields. These systems are seldom capable of handling the volume and variety of today's sewage, especially when the land use is concentrated. The development of wetlands will hasten the time when a community must install or expand a municipal sewer system, necessitating the expenditure of large sums of money for the treatment plant and the attendant collection lines and pumping stations. The time scale involved in the installation and expansion of this system will be reliant on the suitability of any land form to development along with the concentration of the development itself.

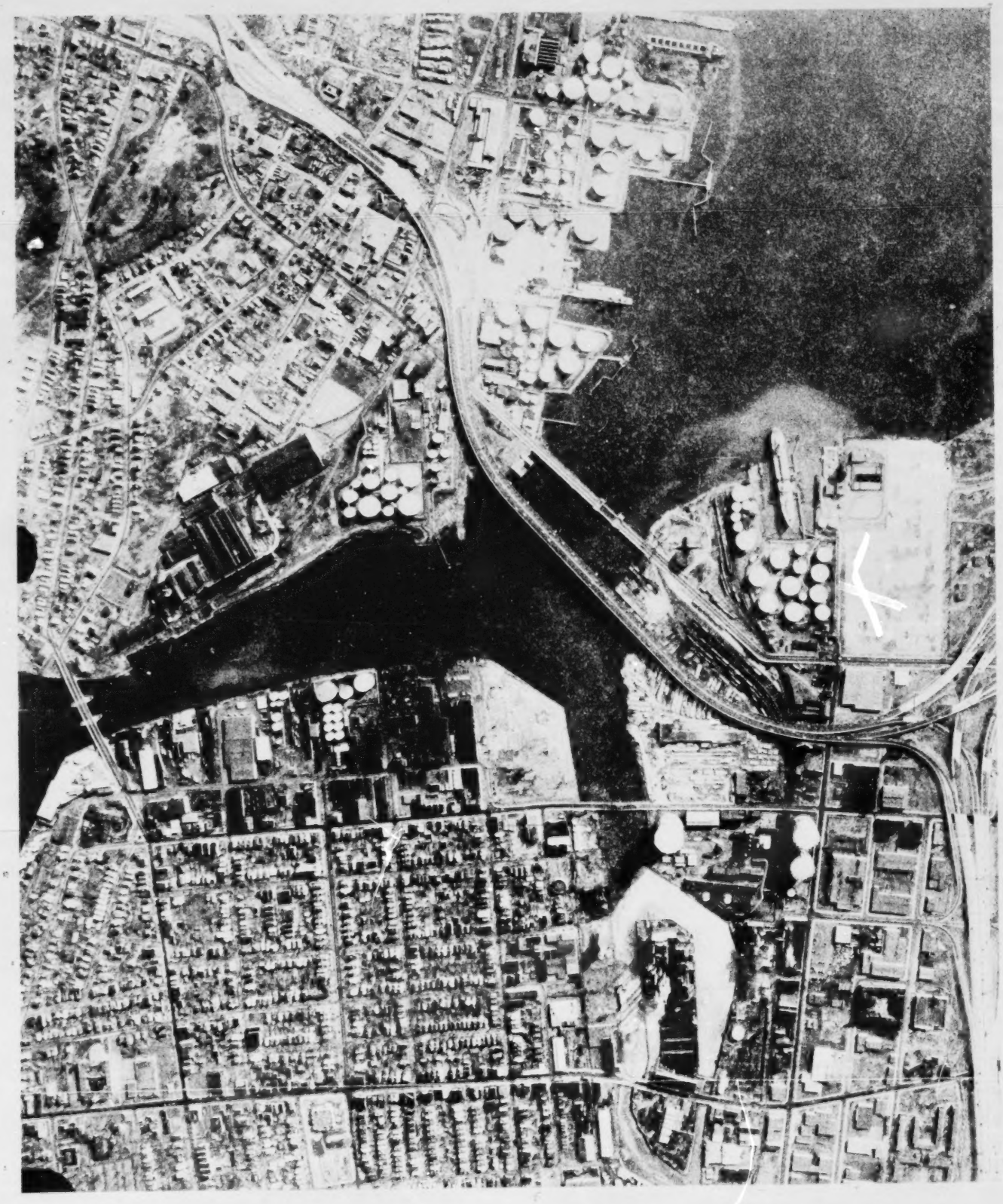
3. Groundwater serves as the water supply of most coastal communities and some problems involved in the proper utilization of this resource can be readily linked to sewage disposal. Private well systems are often plagued by saltwater intrusion and ineffective septic systems, especially in or adjacent to wetland areas. These problems necessitate the extension of a municipal water supply system into areas previously supplied privately. Municipal systems such as those we have mentioned require the outlay of large sums of money, often before the community is realistically prepared to make such a financial committment.

4. Environmental quality and long-range economic welfare go hand-in-hand in the coastal community. It is coastal resources that attract visitors and potential homeowners to these areas. The degradation of any unique land form or the uneducated use of any ecologically valuable area will ultimately result in both the loss of the viable area and the ultimate decline of the community.

B. To illustrate ways in which man, through the exercise of rights of ownership, has used and abused the coastal wetlands, we should like to have <u>you</u> construct a list of activities that have been undertaken, or structures which have been built by wetland owners. To help you start your list, you might refer to the aerial photograph on guide sheet #10, and determine how man has altered this area...

*Source: The Value of Massachusetts' Coastal Wetlands. Massachusetts Department of Natural Resources.

GUIDE SHEET NO. 11



GUIDE SHEET # 12

A. Environmental Alterations and Pollution Caused by Uses of Estuaries and Estuary Resources in the North Atlantic Zone*

Types of Environmental Alteration and Pollution of Estuaries	Uses of Estuaries															
	Agriculture & Forestry	Commercial fishing	Defense	Fish & Wild. Cons. & Mgt.	Industry	Mining	Pest Control	Power production	Recreation	Research	Sanctuaries	Transportation	Urbanization	Waste disposal	Water Supply	Overall severity of alteration or pollution 1/
Filling					x	x			x			x	x	x		G
Deepening			x		x	x	x					x	x			G
Obstruction					x	x		x				x	x	x		M
Shoaling						x						x	x			G
Segmentation					x							x	x	x		G
Isolate habitat					x							x	x	x		G
Drain wetlands	x				x		x					x	x			G
Flood wetlands	x			x			x								x	S
Bulkhead, dike, levee	x				x	x						x	x	x		G
Divert freshwater																O
Modify tidal intrusion																O
Modify circulation					x	x		x				x	x	x		M
Excessive fertility	x				x				x				x	x		G
Reduce fertility																O
Increase turbidity						x						x	x	x		G
Noxious odor					x									x		G
Tributary flow control	x				x			x							x	G
Saltwater barrier																O
Convert to freshwater																O
Modify substrate	x					x						x		x		G
Oil pollution			x		x							x				G
Thermal pollution								x								S
Sewage pollution			x		x				x				x	x		G
Industrial waste	x				x	x								x		G
Agricultural waste	x															S
Solid waste					x								x	x		G
Pesticide pollution	x						x						x	x		G

1/ S-Small, M-Moderate, G-Great, O-None

*Source: National Estuary Study, Department of the Interior, Fish and Wildlife Service, January 30, 1970.

B.

1. Vital Areas or Preservation Areas: Ecosystem elements of such critical importance and high value that they are to be preserved intact and protected from harmful outside forces-encompassed within an areas of environmental concern.

2. Areas of Environmental Concern or Conservation Areas: Broad areas of environmental sensitivity, often containing one or more vital areas, the development or use of which must be carefully controlled to protect the ecosystem.

3. Areas of Normal Concern or Utilization Areas: Areas where only the normal levels of caution are required in utilization and in development activity.

GUIDE SHEET # 13

SUMMARY OF STATE AGENCY INVOLVEMENT IN THE COASTAL AREA

Chart indicates State agencies by Department that are most directly involved with 14 major issues identified for the Coastal Area

ISSUE	TYPE OF AUTHORITY* OF STATE AGENCIES BY DEPARTMENT							OTHER STATE AGENCIES
	Community Affairs	Environ. Protect.	Finance & Control	Agriculture	Commerce	Health	Transportation	
Industrial and Commercial Development	2,4	P1	4	4	P2,4	1	1	
Residential and Institutional Development	P2,3,4	P1	4	P2	P4	1	1,3	Public Utilities Commission
Water Supply		2,4	4			P1,3	3	PUC, IWRPB**
Water Quality		P1,2,3,4	4	4		P1,3	4	IWRPB
Air Quality		P1,3	4		4		4	
Shoreline Appearance		2			4		4	
Erosion and Sedimentation		P1,2,3,4		2			P4	
Flood Damage Reduction		P1	4	2			P2,3,4	
Coastal Recreation	4	P2,4	4	2	P4	P1	3,4	
Wetlands and Critical Areas Preservation		P1,4	4		P4	P1		Historical Commission
Agriculture and Aquaculture		P1,2	4	P1,2,4		P1		
Transportation		1,3,4					P1,2,3,4	
Mineral Extraction		P1,4			4		4	
Energy		1,2,3			4	3	2,3,4	PUC

*AUTHORITY TYPES:
1. Regulatory
2. Funding
3. Review
4. Planning or Promotional

P - Agency has a policy which directly addresses the issue
** Interagency Water Resources Planning Board

*Source: Connecticut's Application for Federal Assistance under the Coastal Zone Management Act of 1972 for Period July 1, 1974 through June 30, 1975.

GUIDE SHEET # 14

coastal zone management program

Source: DEP CITIZENS' BULLETIN Vol 2 No. 1, October 1974.

The proposal (available from DEP Room 117) states that the overall goal of the Coastal Zone Management program is protection, preservation and restoration, as well as the desirable economic utilization, of Connecticut's coastal resources. To achieve this goal, the following preliminary objectives are established:

- To encourage and control industrial, commercial, residential and institutional development in such a manner that cultural and economic benefit to people is maximized and adverse effects upon the natural resources of the coastal area are minimized.

- To provide for the receiving, handling and distribution of commodities, and satisfy needs for improved cross-Sound movement of people, both in an efficient, yet environmentally and socially acceptable,manner.

- To preserve and protect areas of unique, scarce, fragile or vulnerable natural habitat, historical significance, cultural value, and scenic importance.

- To improve and upgrade existing water quality in order to meet appropriate standards.

- To provide sufficient quantity and diversity of recreational opportunities in the coastal area.

- To minimize damages sustained from tidal and riverine flooding through the use of solutions that have the smallest possible adverse effect on coastal resources.

- To minimize damage sustained from coastal and upland erosion and sedimentation through the use, where possible, of solutions wherein the natural long-term functions of Long Island Sound and the coastal area's rivers and estuaries are allowed to occur.

- To ensure efficient and environmentally acceptable fuel distribution, power plant siting, transmission of electricity, and conservation of energy.

- To maximize the productivity, enjoyment and economic value of the marine fishery resource.

- To protect and enhance the productivity and enjoyment of the shoreland wildlife resource.

- To provide adequate land based transportation to facilitate the movement of goods and people.

- To achieve and maintain a detailed data base upon which governmental guidelines, policies, decision-making, and regulatory activities can be based.

- To establish and carry out unified policies, criteria, guidelines and standards for effective and coordinated management of the coastal area by all involved governmental units.

Turn the tape recorder on when you are ready to continue.

GUIDE SHEET # 15

PROBLEMS AND ISSUES OF CONNECTICUT'S COASTAL ZONE PROGRAM

Excerpted from Connecticuts Application for Federal Assistance
and the Coastal Zone Management Act of 1972

"A. Competing Land and Water Uses. Connecticut's coastal area lies entirely within the Boston-New York-Washington "megalopolis", the most populated and intensely developed region of comparable size in the United States. Governmental planning and oversight of competing demands on management of human and natural resources in terms of such characteristics as their diversity, carrying capacity, and productivity.

Development is heaviest along the coastline and in major river valleys. It is these areas that are most prone to flood and hurricane damage. Development has failed to take into account environmental extremes, thereby greatly increasing the potential for loss of lives and property in flood-prone and exposed areas.

Issues and Problems:

1. development in flood-prone areas
2. control of public and private shoreline development
3. air pollution from "indirect" or "complex" sources such as transportation facilities
4. construction, improvement and use of inefficient transportation facilities and patterns
5. eradication of waterfront blight
6. development of port and harbor facilities

B. Critical Areas Protection. Tidal wetlands, salt marshes, beaches, estuarine areas, bluffs, and other critical areas were once abundant in Connecticut's coastal area. Those remaining must be assured of permanent protection. Growth pressures and poor water quality continue to threaten their viability and continued existence.

Issues and Problems:

1. preservation and protection of tidal and inland wetlands
2. protection and utilization of beaches
3. management of estuaries
4. management of offshore islands
5. protection of other areas of high ecological, cultural and historic value

C. Recreation. A very small percentage of the Connecticut coastline is accessible to the public. Consequently, recreational opportunities normally identified with the shoreline are limited. Recreational boating is limited by inadequate mooring facilities and public boat launching sites. Navigation hazards are caused by overcrowed mooring areas.

Issues and Problems:

1. heavy demand for and limited supply of public beach areas
2. lack of boating access
3. limited accessibility to coastline in general; private vs. public ownership
4. highly developed areas along the coastline
5. improvement of water quality for swimming

GUIDE SHEET # 15
(continued)

PROBLEMS AND ISSUES OF CONNECTICUT'S COASTAL ZONE PROGRAM

Excerpted from Connecticuts Application for Federal Assistance
and the Coastal Zone Management Act of 1972

D. Water Supply and Water Quality. According to findings of the LISTS, the waters of Long Island Sound receive about 190 million gallons of municipal and institutional wastes per day. Industrial discharges introduce toxic substances, such as heavy metals, oil, grease, and acids, into the Sound and the rivers and estuaries of the Coastal Area. Pollution of the coastal area's waters have had adverse effects on aquatic, and marine biological systems and on commerical and recreational activities.

Projected water supply demands for the coastal area are 73.3 million gallons per day for 1990 and 135 million gallons per day for 2020, using both surface and groundwater sources.

Issues and Problems:

1. improvement of existing municipal sewage treatment facilities
2. improvement of treatment of industrial wastes
3. combined sewers
4. dredging and dredge spoil disposal
5. oil spills
6. vessel wastes
7. pollution from non-point sources
8. water supply
9. preservation and protection of public water supply watershed lands

E. Energy. As is apparent nationwide, energy demands have exceeded available supplies of petroleum. Conservation of energy must be dealt with on all levels from the private citizen to regional and national levels. Alternative sources of energy must be explored and utilized. Of major significance to the coastal area is the distribution of petroleum and petroleum products, the siting of power facilities, and the transmission of electrical energy.

Issues and Problems:

1. location of power generating plants and their environmental effects
2. improvement of petroleum distribution
3. energy conservation through improvement of transportation modes and patterns, and transmission of electricity

GUIDE SHEET # 16

MANAGEMENT PRINCIPLES AND RULES*

The following fifteen Management Rules and Principles are found upon the Ecologic Principles and are the basis for the practical series of Recommended Constraints:

MANAGEMENT PRINCIPLES

1. Ecosystem integrity: Each coastal ecosystem must be managed with respect to the relatedness of its parts and the unity of its whole.

2. Drainage: A fundamental goal of shoreland management is to retain the system of land drainage as near to the natural pattern as possible.

3. Drainageway buffers: The need to provide vegetative buffer area along drainageways increasing with the degree of development.

4. Wetlands and tidelands: The need to preserve wetlands and vegetated tidelands increases with the degree of development.

5. Storage: Storage components of ecosystems are of extreme value and should always be fully protected.

6. Energy: To maintain an ecosystem at optimum function it is necessary to protect and optimize the sources and the flows of the energy that power the system.

MANAGEMENT RULES

1. Drainageways: Alteration of any drainageway by realignment, bulkheading, filling, impounding, or any other process that shortcuts the natural rate of pattern of flow or blocks or impedes its passage is unacceptable.

2. Basin circulation: Any significant change from the natural rate of water flows of a coastal water basin is presumed to be ecologically detrimental and is unacceptable.

3. Nutrient supply: Reduction of the natural supply of nutrients to the coastal ecosystem by alteration of fresh water inflow is unacceptable.

4. Nitrogen: Discharge of nitrogenous compounds into confined coastal waters is presumed to have adverse effects through eutrophication and is unacceptable.

5. Turbidity: Turbidity of higher than natural levels is to be presumed detrimental to the coastal ecosystem and is unacceptable.

6. Temperature: Significant alteration of the natural temperature regime of the coastal ecosystem is presumed adverse and is unacceptable.

7. Oxygen: Any significant reduction from the natural concentration of oxygen is presumed to be adverse and is unacceptable.

8. Salinity: Any significant change from the natural salinity regime is presumed ecologically detrimental and is unacceptable.

9. Runoff contamination: Any significant discharge of suspended solids, nutrients, or toxic chemicals is to be presumed adverse and is unacceptable.

GUIDE SHEET # 16

(continued)

MANAGEMENT PRINCIPLES AND RULES*

PROGRAM ELEMENTS

Environmental management for the coastal zone should be organized around maintenance at optimum levels of the known properties of the ecosystem, including its features, characteristics, and processes. Planning and management activities should include the following eleven Program Elements:

1. Vital areas: Ecologically critical areas with high value of storage, primary productivity habitat and water purification or regulation.

2. Fresh water inflow: The volume, quality, and rate of delivery to coastal waters of water from outside the coastal management district.

3. Watershed drainage: The factors governing the volume, quality, and rate of delivery of fresh water to coastal waters from the coastal watershed.

4. Circulation: Maintenance of the natural patterns of water movement throughout the coastal water basin.

5. Nutrients: Control of the sources and disposition of naturally occurring and introduced nutrients.

6. Sediments: Control of the sources of sediments from the shorelands, coastal basins and inland areas.

7. Clarity: Control of water turbidity.

8. Temperature: Control of sources of anomalous heating of coastal waters.

9. Oxygen: Maintenance of high levels of dissolved oxygen in coastal waters.

10. Salinity: Maintenance of the natural patterns of salinity in coastal waters.

11. Toxics: Control of sources of toxic discharges to coastal waters.

*Source: Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone by John Clark. Conservation Foundation, Washington, D.C.,1974.

COASTAL WETLANDS

WORDS WORTH KNOWING

Areas of environmental concern. Areas which, because of their environmental significance, require special management considerations.

Bay. A large estuary with a relatively high degree of flushing.

Benthos. The community of bottom-dwelling life.

Biochemical oxygen demand. A measure of the amount of oxygen required to oxidize compounds by biochemical processes.

Biomass. The mass of living matter in a given space.

Biota. The plant and animal assemblage of a biologic community.

Brackish. Fresh water mixed with a small proportion of salt water.

Carrying capacity. (Ecology) The limit to the amount of life, in numbers or mass, that can be supported by any given habitat. (In another context, used to express reasonable limits of human use of a resource.

Circulation. The pattern of movement of water in a coastal basin.

Coastal. Of or pertaining to the seacoast (or Great Lakes shore); specifically shorelands, estuarine basins, and the nearshore ocean.

Coastal waters. Waters adjacent to the shoreline which contain a measurable quantity or percentage of sea water.

Coastal watershed. A drainage basin that drains directly into coastal waters. (Does not include drainage basins that drain wholly, into fresh water channels tributary to coastal waters.)

Coastal zone. All coastal areas and adjoining land forms.

Consumers. Plant eaters.

Decomposers. Microorganisms that decompose tissue.

Detritus. Particles of plant matter in varying stages of decomposition.

Diversity. The variety of species present in a biological community.

Drainage basin. The entire area of shorelands drained by a watercourse in such a way that all flow originating in the area is discharged through a single outlet.

Ecology. The science which relates living forms to their environment.

Embayment. A relatively small and shallow estuary with rather restricted flushing (differs from lagoon by having significant freshwater inflow).

Environmental impact. An environmental change that affects human needs (c.f. ecologic effect).

Estuarine marsh. A marsh in a estuary. The water in the marsh is brackish.

Estuary. Any confined coastal water body with an open connection to the sea and a measurable quantity of salt in its waters. ("Confined" means shoreline length greater and 3 times width of opening. "Measurable" means greater than 0.5 ppt).

Eutrophication. Nutrient enrichment, leading to excessive growth of aquatic plants.

Evapotranspiration. A collective term for the processes of evaporation and plant transpiration by which water is returned to the atmosphere.

Fauna. A collective term for the animal species present in an ecosystem.

Floodplain. The area of shorelands extending inland from the normal yearly maximum storm water level to the highest storm water level in a given period of time (i.e., 5,50, 100 years).

Flora. A collective term for the plant species present in an ecosystem.

Flushing rate. The rate at which the water of an estuary is replaced (usually expressed as the time for one complete replacement).

Food chain. The step-by-step transfer of food energy and materials, by consumption, from the primary source in plants through to increasingly higher forms of fauna.

Food web. The network of feeding relationships in a biological community.

Foragers. Animals that feed on consumers.

Habitat. The place of residence of an animal species or a community of species.

Intertidal area or tidal flat. The area between high and low tide levels. (unvegetated).

Photosynthesis. The manufacture of carbohydrate food from carbon dioxide and water in the presence of chlorophyll, by utilizing light energy, and releasing oxygen.

Phytoplankton. The plant component of the plankton.

Plankton. Small suspended aquatic plants or animals which passively drift or swim weakly.

Predators. Animals that feed primarily on foragers.

Primary productivity. The amount of organic matter produced by photosynthesis.

Producers. Green plants, photosynthesizers.

Salinity. A measure of the quantity of dissolved salts in sea water (in parts per thousand of water: ppt).

Salt water marsh. A marsh with water from a sound or ocean.

Salt water intrusion. A movement of salt water inland into fresh water aquifers.

Sedimentation. The process of gravitational deposition of soil and other particles transported by water.

Shorelands. The terrain of the coastal watershed down to the upper margin of the wetlands (lower margin of coastal floodplain).

Silt. Fine particulate matter suspended in water.

Spoil. Dredged material.

Storage. Capability of a biological system to store energy supplies in one or more of its components.

Stratified estuary. An estuary with two distinct water layers flowing in opposite directions.

Tidal marsh. A marsh whose water level is influenced by the tides. A tidal marsh can be fresh water or brackish.

Tidal river. The tidally influenced portion of a coastal river.

Tideland. The intertidal area.

Toxic substance. A poison.

Turbidity. Reduced water clarity resulting from presence of suspended matter.

Vital area. A physical component, or feature, of such extreme importance to the functioning of an ecosystem that it requires complete preservation.

Wetlands. Naturally vegetated ares located between mean high water and the yearly normal maximum flood water level.

Zooplankton. The animal component of the plankton.

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Audio Tape Script

Coastal Wetlands

To the casual observer, the tidal marsh in slide # 1 might simply appear to be an uninteresting and valueless expanse of wetland. Close study however reveals an intricate and fascinating community of plants and animals intimately adjusting to an ever changing environment. This unique marsh environment is caused by the tides and mixing of the fresh water from rivers and streams, with the salt water of the sound or ocean. Probably no habitat is more complex to interpret. Slide #1

Tidal ebb and flow brings about a fascinating zonation of plant life from the periodically flooded edge of the marsh to the upper marsh borders which are only occassionally flooded. In addition to characteristic grasses, beautiful wildflowers can be found in tidal marshes.

Coastal wetland animal life is just as spectacular. The water birds such as herons, ducks and rails nest and feed in these areas. East coast marshes also serve as important stops for migrating waterfowl on the Atlantic flyway. Slides 2&3 show some of the organisms which are highly dependent upon coastal wetlands for part or all of their livelihood. Slides #2 & #3

In addition to providing excellent plant and animal habitat, tidal marshes contribute significantly to the productivity of adjacent waters. From these marshes come the basic nutrients that start the food web, which ultimately supports the large number of fish and shell fish in surrounding waters. In this unit, we will explore how a tidal marsh is formed; we will study the characteristic grasses and wildflowers and the marshes diverse animal species. Finally, we will investigate the reasons for the enormous productivity of coastal wetland areas.

Before we begin our discussion in detail, it would be helpful to clarify four terms . . . estuary, estuarine marsh, salt water marsh, and tidal marsh. These four terms are listed and defined at the top of guidesheet #2 (Pause) Turn to guide sheet # 2 and study these terms. Stop the recorder while you carry out this activity (Pause 3 seconds).

The sketch in the middle of guide sheet # 2 shows the relationships which exist among these coastal wetland areas. (Pause) Note the cattails in the sketch, these plants can grow in fresh water or water with low salt concentration. They are very common in fresh water tidal marshes. G.S. #2

The table at the bottom of guide sheet # 2 further explains the differences among coastal wetland classes. (Pause) The crucial difference is the concentration of salt in the water in these areas. The concentration of salt in the ocean and salt water marshes is about 35 parts per thousand. Estuaries and estuarine marshes have a salt concentration of 0.5 to 34 ppt., because in these areas the salt water of the ocean and the fresh water of the river mix.

Let's continue by discussing the formation of a marsh and its characteristic vegetation. Guide sheet # 3 shows a cross section of a salt marsh, while guide sheet # 4 has several pictures of common salt marsh plants (pause 3 sec.). Refer to these two guidesheets frequently during the following discussion. G.S. #3 G.S. #4

Marsh formation begins on the edge of a bay or estuary. The shallow waters of the bay or estuary, offer plants the necessary requirements for active growth and maintenance throughout the

growing season. These factors include warm water heated by the sun, nearly total light penetration due to the shallowness of the water, acceptable soils, and an excellent source of nutrients from the descending river, estuary and open sea.

These factors and the introduction of the primary colonizing marsh plants may lead to the formation of a marsh. Tall, smooth cordgrass with its high tolerance for salt has the ability to grow in a semi-submerged state. As a result, smooth cordgrass grows in a zone between the low and high tide levels and forms the base upon which the future marsh will be formed. Look at zone 2 on Guide Sheet #3 (Pause). The growth and death of plants and the accumulation of debris in the intertidal zone eventually raises the ground level to the point where it is inundated only during the last portion of the flood tide. In this manner, the original substrate becomes modified and permits the growth of salt meadow grass and spike grass. These plants prefer a drier and less saline environment than smooth cordgrass. Look at zones 3 and 4 on Guide sheet # 3 (Pause). In these sections of the marsh, where the organic matter is mixed with and covered by silt and fine mineral particles, air movement is prevented, and anaerobic decomposition occurs. Anaerobic decomposition is accomplished by bacteria in the absence of air. The process gives the marsh substrate its characteristic black ooze texture and a foul "rotten egg" smell. As the marsh surface increases in elevation, the number of floodings and the period of duration of each flooding decreases. This decrease in flooding limits the amount of salt and debris deposited on the area. This raised portion of the marsh includes the third and fourth zone of growth. Salt meadow grass grows in this area where the daily flood tides have an influence, but do not inundate the zone.

The zonation of smooth cordgrass and salt meadow grass shows up clearly in the photograph in the lower left hand corner of guide sheet # 4 (Pause 3 sec.). Slide #4 and on slide #4. When tide pools occur in zones three and four, glassworts, sea lavender, spearscale and marsh goldenrod are often found. The tide pools which form in open depressions on the marsh surface are unique, since they usually contain water of high salinity. . . sometimes exceeding 50 parts per thousand. This high salt level is caused by periodic flooding and constant evaporation of water. High salinity levels are restrictive to most halophytes or salt loving plants with the exception of the glassworts. Glasswort is shown in a photograph on Guide Sheet # 4 (Pause). These fleshy, translucent plants are usually found growing around the edges of tidal pools. As the marsh surfaces ages, tidal pools usually become filled with silt and debris and may then be colonized with salt meadow grass or other plants of the third or fourth zone.

The fifth zone of growth as seen on Guide Sheet # 3, is in reality a continuation of the previous zones, but lacks the influence of the daily flood tide. The elevation of zone 5 exceeds that of zone four by about 2 to 5 inches, and therefore restricts all tidal influence, other than the monthly highest tide. Due to the decrease in salinity and the usual presence of the fresh water table within 1 foot of the marsh surface, zones 5 and 6 have a specialized plant community containing species indicative of a zone of transition. In zones 5 and 6, we find black grass, switch grass and spike rush covering an extensive area and ranging from the marine to the (fresh water) portion of the marsh.

quality. This applies not only to coastal waters but to the upland drainageways and to the land surfaces. It implies that natural patterns of land vegetation and drainage should be retained in land development. Here is an important ecological principle to add to your list on Guide Sheet # 6. Water provides the essential linkage between land and sea elements of the Coastal ecosystem. . . Water provides the essential linkage between land and sea elements of the coastal ecosystem.

Coastal waters are a mixture of fresh water from the land and salt water from the sea. The workings of the coastal ecosystem are influenced by characteristics of both sources of water supply. In a way, the two sources are in competition for the space within the enclosed water basins.

In the context of this competition the ocean water forces apply rather consistent pressure for estuarine space while the land based water forces apply more fluctuating amounts of pressure reflecting seasonal change in precipitation and runoff. For this reason, one looks to the land source-the watershed-for an explanation of intermittent or seasonal changes in such characteristics of the estuarine environments as salinity, circulation patterns and water contents. There is another reason to be concerned with the land sources-they are the ones we constantly alter and can most easily control. G.S. #8

The amount of fresh water arriving in a particular coastal ecosystem varies seasonally.

The volume of the fresh water supply governs the salinity of all coastal waters. Salinity influences the types of species and their abundance and therefore the whole distribution of life throughout coastal waters - fish, shellfish, plankton, plants, and bottom fauna. Normally the salinity gradient established in an estuary fluctuates with the amount of river discharge.

The volume of fresh water inflow also governs the pattern of circulation of coastal waters through the rate of flushing of water basins and the strength of currents. In a stratified or two-layered estuary, the amount of runoff controls both the surface layer outflow and the bottom layer inflow. Circulation strongly influences the abundance and the pattern of distribution of life in the estuary.

Also related to volume is the amount of sediment, nutrient minerals, organic matter, and other substances dissolved or suspended in the water and carried down into the estuary. These materials have a strong influence on the quality of the coastal ecosystem because they affect plant production, oxygen concentration, and the fallout of sediments in estuarine basins. Nutrients supplied naturally via runoff are an important part of the energy budget of many coastal ecosystems.

The rate or schedule of the flow of fresh water into coastal waters is governed by many of the same factors that govern the volume of flow. The schedule of flow is important in its effect on the productivity, stability, and general health of the coastal ecosystem. The natural rhythm or pattern of seasonal flow is generally beneficial.

These are predictable seasonal variations in river flow into the coastal waters of the United States. The total volumes of inflow reflect the total amount of precipitation and the size and slope of the watershed. The detention characteristics of the terrain over which runoff waters flow enroute to the river channel are also important in governing the rate of delivery. The nature

of precipitation also effects river flow. While rain moves directly into the hydrologic system as ground water or surface runoff, snow and ice may remain for months, subsequently causing an influx of many months' precipitation when it melts.

The above considerations lead to the following Ecologic Principle. Add it to your list. The natural volume, pattern and seasonal rate of fresh water inflow provides for optimum ecosystem function. .

Good circulation connotes good environmental conditions. A high rate of flushing, usually considered beneficial, provides transport of nutrients, cleanses the natural system and performs other vital functions. To some extent, good flushing also protects ecosystems stressed by development, because it hastens the dispersal and dilution of pollution. But, there is a limit beyond which the water passes too quickly through the system. For example, a large canal in southwest Florida forces water so rapidly through Fahka Union Bay that the mangrove system has a reduced opportunity to assimilate the nutrients in the water and to store them for use at times of slow discharge. Again it is a matter of balance and one must start with the presumption that the natural condition is best and should be maintained.

These considerations lead to another basic Ecologic Principle. Are you ready to write? Here is the principle. The natural patterns of water circulation within basins provides for optimum ecosystem function.

Sunlight is the basic driving force of the whole ecosystem as part B of guide sheet # 7 indicates. The fundamental source of energy for the growth of plants which in turn supply the foundation of nourishment for all life in coastal waters. For the ecosystem to function well, sunlight must be able to penetrate the water to a considerable depth so as to foster the growth of rooted plants and the phytoplankton that float beneath the surface. G.S. #7

Turbidity from suspended silt or from concentrations of organisms has a negative effect upon the amount of plant growth that can occur in coastal waters. In this way the growth of phytoplankton is self limiting. As the growth becomes denser the water becomes more turbid, thus decreasing the penetration of light into the water. Where light penetration is blocked by silt or by phytoplankton, there may be little growth occurring beneath a shallow surface layer. Estuaries are normally more turbid than ocean waters, being more silt laden and richer in nutrients and phytoplankton.

Light also affects the behavior of many animals. For example, many predatory gamefish are visual feeders and are benefited by good light penetration. Conversely, the tiny young stages of many coastal fish seek refuge in estuarine waters to escape predators. Neither extremely clear nor extremely murky water is totally desirable. It is necessary to prevent the addition of silt that would block light penetration, or of nutrients that would stimulate excessive plankton growth and lead to this same condition. This leads to yet another ecological principle. The natural variation found in light in a natural coastal wetland provides for optimum ecosystem function.

Temperature exerts a major influence on the coastal ecosystem. The occurrence of any one species and the mix of whole coastal water communities of life tend to vary from north to south with

quality. This applies not only to coastal waters but to the upland drainageways and to the land surfaces. It implies that natural patterns of land vegetation and drainage should be retained in land development. Here is an important ecological principle to add to your list on Guide Sheet # 6. Water provides the essential linkage between land and sea elements of the Coastal ecosystem. . . Water provides the essential linkage between land and sea elements of the coastal ecosystem.

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Temperature exerts a major influence on the coastal ecosystem. The occurrence of any one species and the mix of whole coastal water communities of life tend to vary from north to south with

changing temperature. Many fluctuations of aquatic animals are temperature controlled; for example, migration, spawning, feeding efficiency, swimming speed, embryological development and basic metabolic rates are all temperature sensitive.

Temperature alteration-such as may be caused by plant effluents or changes in waterflow patterns - is particularly critical in estuaries because life is so concentrated, so many important species resort to estuaries for certain key life functions. The optimal temperature for any water habitat depends not only on the preferences of individual species but also on the well-being of the system as a whole. An ecological system is in dynamic balance and like a finely tuned automobile engine, any damage to a single component, can disable or impair the efficiency of the entire system.

In this case the relevant ecologic principle is as follows: the natural temperature variations which occurr in natural wetlands provide for optimum ecosystem function.

Of the various gases that are found dissolved in coastal waters, those of greatest importance in the web of life are oxygen and carbon dioxide, both of which occur in small but vital quantities. Animals use oxygen and produce carbon dioxide. Plants use carbon dioxide and produce oxygen. Therefore, each form can benefit from the other's work - one's waste is the other's need. There is a critical balance in the cycle between plants and animals that also involves transfer of dissolved gasses across the water surface to and from the atmosphere. Here we find an additional ecological principle. High concentrations of dissolved oxygen provide for optimum ecosystem function. There is little evidence to show that one need be concerned about harmful effects from excess oxygen in coastal systems.

Important chemicals in coastal waters fall into two classes: nutrients and trace-elements. The nutrients are vital to the whole chain of life in coastal waters because they are required by all plants, whether rooted plants or microscopic phytoplankton. In addition, they are very important because the animal life is supported by the plants. Free nutrient chemicals are relatively scarce in the waters of a natural coastal ecosystem because they are taken up rapidly by plant life. A supply of nutrients into the system by natural processes of runoff, rainfall, and other ocean sources, to replace losses and keeps the ecosystem functioning optimally. This natural supply is a critical need and one cannot expect to successfully substitute for nature by providing an artificial supply.

Nutrients are recycled in a relatively short time in coastal ecosystems. Marshes produce an excess of organic material. At the end of each growing season, marsh grasses are broken down by bacterial decomposers to produce detritus. This detritus is utilized directly as a food source by marsh organisms and is also washed into the coastal estuaries by fluctuating tides, what becomes basis for estuarine food chain. It has been estimated that two thirds of commercially valuable fin fish and shell fish spend part or all of their life cycle in salt marsh estuarine ecosystem and play an integral role in the complex food web of the estuary. The major plant nutrients that we are concerned about in the estuary and environment, are nutrients called nitrates and phos-

phates. The nitrogen content of plant tissue is much higher than that of the phosphates in plant tissue. In coastal waters the amount of available nitrate is generally believed to be the nutrient factor that controls the abundance of plants. Here then, is another basic ecological principle. Productivity in coastal waters is normally governed by the amount of available nitrogen.

The concept of primary productivity refers to the capacity of an ecosystem to produce basic plant material. Primary productivity is the amount of energy converted from light, nutrients and carbon dioxide to plant tissues. In terms of primary productivity, estuarine water bodies may produce 20 times as much as the deep sea and 10 times as much as either nearshore waters or deep lakes. Since primary productivity governs the ecosystem's total capacity for life, estuaries are generally more productive than the ocean.

Actual abundance of an ecosystem is a reflection of the productivity of that ecosystem. Table I on guidesheet # 10 illustrates the productivity of the estuarine ecosystems we have discussed. Even though the coastal wetlands and estuaries are only a small percentage of the ocean's area, they represent 50% of the annual fish production. By comparing actual abundance of life with potential abundance, an ecologist can determine if the system is malfunctioning and needs attention. G.S. #10

Energy needs of coastal ecosystems are met in two ways: first, from external driving forces and second, from internal supplies that are recycled within the system. The major external driving forces of coastal ecosystems are tide, ocean currents, river inflow, wind, sunlight and the basic inorganic nutrients that nourish plants and animals, as slide #6 illustrates. The appropriate Ecological Principle here is: The flow and amount of available energy governs life processes within the coastal ecosystem. Slide #6

Internally, the chain of life - begins with energy assimilated by plants. Plants, the producers use the energy of sunlight in photosynthesis to transform carbon dioxide and basic nutrients into plant tissue, a form of energy which is available to animals as their basic foodstuff. The plants are then eaten and passed through the complex food web and back to basic nutrients. Guide sheet # 9 shows how this system functions. Because all animal food starts with plants, every organism ultimately depends on the major factors that limit the building of plant tissues, such as access to sunlight. G.S. #9

Storage capacity is also an exceptionally important aspect of coastal ecosystems. Storage is the capability of a system to store energy supplies in one or more of its components. Such a storage unit can be a stand of marsh grass, a fish school, a seed, organic sediment on the bottom of phytoplankton in the water of a bay. These units all gather and store a supply of energy that is in reserve against shortages.

Storage in plant tissues is particularly important because the reserve of nutrients stabilizes the system and provides a buffer against irregular heavy stresses or seasonal shortages. Storage is nature's hedge against boom-or-bust fluctuations of abundance and scarcity, according to the following Ecologic Principle. Here is another important addition to your list. A high capability for energy storage provides for optimum ecosystem function.

Estuarine vegetation is particularly important as a storage unit. For example, marsh grass

in its entirety - roots, leaves, flowers, stems - provides storage upon which the regularity of nutrient supply to the estuarine food chain depends. Slide #7 is a cross-section of the tidal marsh grass, roots and soil. In addition, marshes have vast quantities of nutrient stored in their soils which provide an always available source of nourishment to the marsh grasses, as explained in part B of guide sheet # 10. Stop the recorder and read the paragraph on guide sheet # 10. When you are finished, turn the recorder back on. Slide #7. G.S. #10B

In our discussion of the coastal zone, we have focused on the geographical unit that embraces all of the life and physical components of one distinct interacting shoreland and adjacent coastal waters. Ecologically, these relationships of living forms to their environment, has been the underlying concept of our discussions. Ecosystem orientation stresses that management of coastal water areas must be coupled with the management of adjacent shorelands and fresh water sources. This brings us to the final and probably most important ecological principle in our list: No one part of an ecosystem operates independently of any other.

This principle does not apply to the coastal ecosystem but to any ecosystem in the biosphere. All the parts of an ecosystem are linked together. It is impossible to operate any one independent of any other. This principle will apply to all our discussions on land use decision making in the other units.

Up until now, we have concentrated on the natural value of an estuarine type of ecosystem that derives from confinement, salinity, circulation, tide, and nutrient storage. We have discussed how this leads to salt marsh formation and why the estuary is such a productive ecosystem. Guide sheet #11 summarizes the ecological principles we have discussed. Compare our list with the list you have been keeping. (Pause) Now, let's turn our attention to some of the other values of the coastal ecosystem. G.S. #11

Take a look at guide sheet #12. Stop the recorder while you complete the activity on guide sheet #12. G.S. #12

In the coastal zone, there occurs an array of wildlife not readily evident to the man in the street. In the naturalist or careful observer, the marsh represents a fascinating diversity of waterbirds. To the hunter these offer exciting outdoor sport. And still others find these wetlands and the immediately adjacent waters a place where they can enjoy fishing, crabbing, claming and just relaxing.

Look now at slide # 8. Slide #8

Of the wildlife associated with the marshes, birds are the most conspicuous. Among those that breed in or are completely dependent upon the salt marsh for their food are the rails and sparrows. The rails are narrow-bodied birds, uniquely adapted for slipping between the dense vertical stems of the grasses and reeds. They feed on insects, snails and small crustaceans. Being elusive and retiring and most active in the twilight hours, they are seldom seen by the casual observer. Other birds nesting in the marshes include the song birds, black duck, blue-winged teal, common bittern, willet, marsh hawk, short-eared owl, red-winged blackbird, meadowlark and marsh wren. Besides these species, there are even larger numbers which are dependent upon the marshes and adjacent estuarine waters for food. Among these are the large spectacular wading

birds - the great blue heron, the American egret and a number of smaller herons. The black skimmer, skims the shallow waters for small fish. In the spring and fall and during the winter months large numbers of migratory waterfowl breed in the far north and frequent the marshes. Among these are the many species of ducks and geese. The geese are grazers and are, therefore, highly dependent upon the roots and stems of the marsh grasses.

The food for this great diversity of bird life is derived either directly or indirectly from the marshes. Here upwards of twenty genera of marsh insects, eighteen genera of bivalves, and fifteen genera of crustaceans contribute not only to this avian food chain but also to man's prized shellfish resources. The small fish of the shallow adjacent waters, the killfish, minnows, and silversides are a vital part of this complex web of life. They serve several roles. They furnish a food source for this large and diverse bird population; they aid in reducing the population of mosquito larvae; and they may also become the prey of our larger fishes, thus contributing to our commercial and sports fishing resources.

Other animal life on the marsh includes the diamond-backed terrapin and several species of mammals. Muskrats and meadow mice inhabit the marshes the year round, and in some areas the muskrat is "harvested" for its fur. Other mammals frequently visiting the marsh include deer, fox, raccoon, skunk and opossum. Slide #9

In this description, we have shown how the tidal marshes support one of our richest wildlife populations, intricately adjusted and interdependent upon the existing natural setting. Furthermore, it has been emphasized that the tidal marshes cannot be isolated as a specific ecological entity. Instead, we find a closely-knit interacting complex of habitats involving not only the marsh, but also the adjacent waters, the salt ponds, bays and estuaries.

Diversity expresses the variety of species present in an ecosystem. It is generally assumed that a high diversity of species both plant and animal is to a better eco-system balance and provides a greater resiliance to a catastrophic event such as disease or storms. Conversely a low diversity may indicate a stress system or one that has been degreated for example by pollution. The flora and fauna of a coastal system exhibit a rich diversity of species. Most ecologists agree that diversity tends to stabalize biological systems. A corn field is much less stable ecologically than a coastal wetland. In an artificially managed ecosystem such as a corn fields, man must add considerable energy in the form of fertilizer, pesticides, etc. to keep them productive and stable. Such is not the case with natural coastal wetlands.

Now look at slide #10. Slide #10

Connecticut's coastline is constantly pounded by waves which are often intensified by coastal storms. By their nature though, coastal wetlands can considerably reduce the imoact of these waves. As a wave moves toward the shore, it first encounters the tidal flats where much of its energy is diffused. It continues shoreward and encounters a barrier beach which absorbs most of the remaining impact - although some of the energy leaks through, via the natural inlets, into the estuarine/marsh system.

Some degree of interaction also occurs between the coastal waters and the contiguous freshwater

marshes lying inland from the salt marsh. These freshwater marshes act as a buffer, protecting the inland from coastal flooding and the estuarine marsh area from adversely high levels of terrestrial runoff caused by spring thaws and inland storms.

The coastal wetlands act as a sponge, holding the excess water from extra high tides and excessive storm runoff. The natural storm buffer can be easily lost when the wetlands are filled for industrial or housing development. Once the wetland is filled, the storm water has no place to dissipate its fury except on the upland shore and its man-made structures. Often storm damages, as in the 1957 Hurricane, are increased because of extensive loss of coastal wetlands.

Coastal wetlands also perform another hydrological function. The wetlands, rich in micro-organisms, act as a pollution filter. The micro-organisms are able to digest many of the organic pollutants and convert them into an acceptable form to enter the food chain. Micro-organisms can also absorb excess nutrients and convert them to forms that can be utilized or stored. The functions of the coastal wetlands as a pollution treatment facility is often overlooked in valuing the wetlands.

Coastal wetlands and estuaries can serve as resource and study areas for scientific research and as outdoor educational exhibits -- living museums where the dynamics and ecological role of these ecosystems can be taught. In education, these outdoor laboratories can be used to emphasize such basic ecological principles as energy flow, the stability of diversity, recycling, and limited carrying capacity. All these are directly related to man and the environmental problems he has created by failing to recognize their pertinence to human ecology.

Now look at slide #11. Slide #11.

Wetlands also provide a great recreational outlet. Fishing and hunting are still important forms of recreation for many citizens. Others stalk the wetlands with binoculars, where the great diversity of waterfowl and spectacular waterbirds gives pleasure and inspiration. Wetlands can be incorporated into the untouched, open spaces of every town, thus becoming a part of our necessary commitment to open lands.

And finally, but not least in value, is the aesthetic value of coastal wetlands and estuaries. as is illustrated by slide #12

Scenery must be seen to be enjoyed, and the picture we carry in our minds of some beloved area such as that in this last slide, is based on outlooks from which the eye can take in at a glance a sweeping view of the landscape. Vistas require a certain amount of openess in the foreground such as is created by a meadow, a coastal wetland, or a body of water. The aesthetic value of the coastal zone should not be overlooked. Slide #12

Coastal Wetlands II

Somewhere between seven and fourteen thousand years ago the glaciers retreated across New England, leaving approximately 40,000 acres of salt-water tidal marsh along the Connecticut coast. Today about 14,000 acres of tidal marsh remains. More than half of the original marsh area has been destroyed by man's activity. The total of Connecticut's coastal wetlands includes these 14,000 acres of salt water marsh and an additional 5,000 acres of brackish and fresh water tidal marshes.

What has been the cause of tidal marsh destruction? Is there a single agency or groups responsible for destroying tidal marshes? A recent publication of the Fish and Wildlife Survey can help us answer these questions. A summary of the survey is reproduced on guidesheet #2. (Pause 3 sec.) While you are reading the guidesheet # 2 consider these two questions. What are the causes of the destruction of coastal wetlands and where is the destruction occurring? (Pause 5 sec.) Part B of the guidesheet indicates that the major cause of marsh destruction has been indiscriminate filling by private landowners. Significant losses have occured as part of programs planned and implemented by municipalities and the state for parks, roads or waste disposal. Our question about location of marsh destruction, is answered in Part C of Guidesheet # 2. G.S. # 2

From this data, we see that the greatest marsh destruction has occurred near heavily populated areas (5 sec.).

On guide sheet # 3, there are two maps which provide important information on the proximity of Connecticut's coastal wetlands to areas of intensive urban development. There are only two small sites on the entire Connecticut Coast which were not classified by the Interagency Water Planning Board as intensive urban development areas. Study both maps on Guide Sheet # 3 . . . locate a few of Connecticut's remaining coastal marshes on map A and determine whether or not the sites you select are in areas of intensive urban development by approximating their location on map B. Turn off the recorder while you carry out the activity. G.S. #3

Before discussing present land use decisions involving the tidal marshes, it may be helpful to develop a historical perspective on how man has interacted with coastal wetlands from pre-colonial settlement days to the present.

An insight into how past human activities have affected the present conditions of our marshes and estuaries might best be obtained by taking an in depth look into the history of one of Connecticut's important coastal marshes - The Quinnipiac River marsh.

The Quinnipiac marsh is a large estuarine marsh located in the valley of the Quinnipiac River. It was formed subsequent to the retreat of the Wisconsin glacier

OVER 10,000 YEARS AGO. THE MARSH HAD BEEN GROWING AND CHANGING, FOR THOUSANDS OF YEARS BEFORE MAN HAD HIS FIRST IMPACT ON THE MARSH. THE PROCESS OF MARSH FORMATION AND EVOLUTION IS DISCUSSED IN PART I OF THIS UNIT.

THE AMERICAN INDIAN WAS PROBABLY THE FIRST HUMAN GROUP TO REALIZE THE ABUNDANCE OF FOOD COASTAL WETLANDS HAD TO OFFER. INDIANS HUNTED GAME WITHIN THE MARSHES AND ON THE RIVER SHORES. THEY FISHED IN THE WATERWAYS AND HARVESTED EDIBLE PLANTS. SINCE THE COASTAL WETLANDS SUPPLIED SO MANY OF THEIR NEEDS, THE INDIANS BUILT VILLAGES NEAR THE COASTAL WETLANDS. RECENT EXCAVATION AT THE SITE ADJACENT TO THE QUINNIPIAC MARSH, CALLED THE BURWELL-KARAKO SITE, HAS PROVIDED EVIDENCE THAT MANY DIFFERENT INDIAN TRIBES POPULATED THIS COASTAL WETLAND AREA. RADIO-CARBON DATING OF MATERIAL REMOVED FROM THE SITE INDICATES THAT IT HAS BEEN USED INTERMITENTLY FOR SOME 3,000 YEARS.

BECAUSE OF THEIR SMALL NUMBERS, THE EFFECTS OF INDIAN SETTLEMENTS WERE NEGLIGIBLE. OCCASIONALLY THERE WERE FIRES IN THE MARSH, BUT IT IS NOT CLEAR WHETHER THEY WERE ACCIDENTAL OR PLANNED. IT WASN'T UNTIL THE FIRST EUROPEAN SETTLERS ARRIVED IN 1637 THAT THE HUMAN IMPACT ON THE MARSH BECAME SIGNIFICANT.

THE SETTLEMENT OF THE MOUTH OF THE QUINNIPIAC RIVER ILLUSTRATES A PATTERN THAT WAS REPEATED MANY TIMES ON THE NEW ENGLAND SEASHORE. JOHN MASON, WHILE PURSUING THE PEQUOT INDIANS FROM A BATTLE NEAR MYSTIC, SAW SMOKE IN THE AREA OF THE QUINNIPIAC RIVER DELTA. HE ANCHORED AND MET A GROUP OF FRIENDLY INDIANS KNOWN AS THE "QUINNIPIAKS". AS A RESULT OF OBSERVATIONS MADE DURING HIS VISIT, MASON NAMED THE PENNINSULA "FAIR HAVEN" AND RECOMENDED THAT A COLONY BE STARTED IN THIS "NEW HAVEN". THE FOLLOWING YEAR, 16[illegible], JOHN DAVENPORT AND THEDIUS EATON LED A GROUP OF COLONISTS TO "NEW HAVEN" AND, BY BARTERING A FEW KNIVES, SPOONS AND SCISSORS, SECURED A 100 SQUARE MILE AREA OF LAND FROM THE QUINNIPIACS. BY AGREEMENT, THE INDIANS WERE TO LIVE ON A 1900 ACRE AREA ON THE EAST SIDE OF THE RIVER

AS ADDITIONAL COLONISTS ARRIVED, THEY OCCUPIED THE UPLAND SHORES OF THE QUINNIPIAC MARSH, HARVESTING VAST QUANTITIES OF GRASS FROM THE OPEN "SALT HAY" FIELDS. SLIDE 1. THE HAY WAS USED AS FORAGE, BEDDING, PACKING, ROOF THATCHING AND MULCH. LIVESTOCK ALSO GRAZED ON THE MARSHES UNTIL THE NUMBER OF ANIMALS BECAME TOO LARGE TO MANAGE. AFTER THIS POINT, CATTLE WERE PUT ON UPLAND PASTURES AND THE SALT MARSH HAY WAS CUT FOR FEED. THE HAY WAS COLLECTED DURING THE WINTER MONTHS WHEN THE MARSH DEPOSITS WERE FROZEN AND THE HAY COULD TRANSPORTED TO SHORE. OFTEN, THE COLONISTS BURNED THE MARSH AFTER THE HAY HARVEST IN AN EFFORT TO CONTROL THE INVESTATION OF BITING GREEN HEAD FLIES.

THE MARSH HAD NEVER FAILED TO PROVIDE THE EARLY SETTLERS WITH A VARIED AND ABUNDANT SUPPLY OF FISH AND GAME. BUT, ALL OF A SUDDEN, THE PRODUCTIVITY OF THE MARSH BEGAN TO DECLINE. THE NUMBER OF WATER FOWL AND SHORE BIRDS DECLINED IN RESPONSE TO EXCESSIVE HUNTING AND HABITAT MODIFICATION. EXTENSIVE AREAS OF THE MARSH BECAME CLOGGED WITH TOPSOIL SEDIMENTS WHICH ERODED FROM ADJOINING UPLAND FARMS...OVERHARVESTING OF THE MARSH GRASSES TOOK ITS

TOLL ON THE ABILITY OF THE MARSH TO CONSTANTLY RENEW ITSELF. THE MARSH WAS NO LONGER WELL PROTECTED BY MATS OF DEAD GRASS. THE CHANGES THAT MAN HAD BROUGHT ABOUT INTERRUPTED THE NORMAL FUNCTION AND CYCLES OF THE COASTAL WETLANDS AND THEIR PRODUCTIVITY DECLINED.

AT THE BEGINNING OF THE INDUSTRAL ERA IN NEW HAVEN, THE QUINNIPIAC MARSH AND NUMEROUS LOCAL FARMS WERE BEING ABANDONED AS A RESULT OF DECLINING AGRICULTURAL PRODUCTIVITY. IN THE MID 1800'S THE RAILROAD BECAME THE OPENING WEDGE WHICH INDUSTRY FOLLOWED INTO THE MARSH. TODAY, THE RAILROADS, INDUSTRY, COMMERCIAL ESTABLISHMENTS AND INSTITUTIONS ENCROACH UPON THE MARSH. ON GUIDESHEET # 4 THERE IS AN AERIAL PHOTOGRAPH OF THE QUINNIPIAC MARSH. THE RAILROAD YARDS STILL DOMINATE THE MARSH IN THIS AREA. G.S. #4

LET'S UTILIZE THE AERIAL PHOTOGRAPH ON GUIDE SHEET # 4 TO ANALYZE MAN'S IMPACT ON THIS TIDAL MARSH. TAKE A CLOSE LOOK AT THE AERIAL PHOTOGRAPH ON GUIDE SHEET # 4 . . . AS YOU STUDY THE AERIAL PHOTOGRAPH, SEE IF YOU CAN LOCATE THE SITES WHICH ARE LISTED AT THE TOP OF GUIDE SHEET # 5. STOP THE RECORDER FOR THE ACTIVITY. WHEN YOU HAVE LOCATED ALL OR MOST OF THE SITES TURN THE RECORDER BACK ON . . . (PAUSE 5 SEC.) G.S. #5

AS YOU CHECKED OFF YOUR OBSERVATIONS OF MASS IMPACT ON THE MARSH, YOU SIMPLY IDENTIFED SITES. NOW LETS EXAMINE THE IMPACT THAT MAN'S STRUCTURES AND ACTIVITIES HAVE ON THE MARSH. TO BEGIN WITH, LET'S CONSIDER THE IMPACT THE RAILROAD YARDS. THE TRACK RIGHT OF WAY COVERS A LARGE LAND AREA IN WHAT WAS PART OF THE QUINNIPIAC MARSH. THE CONSTRUCTION OF THE RAILROAD COMPLEX INVOLVED A TREMENDOUS FILLING OPERATION. MANY ACRES OF MARSH WERE DESTROYED BY THE ADDITION OF FILL TO SUPPORT THE TRACKS. THE ROADBEDS ISOLATED MANY SECTIONS OF THE MARSH FROM THE FLUSHING ACTION OF THE TIDAL WATER. THE IMPACT OF ISOLATING SECTIONS OF THE MARSH IS OFTEN THE SAME AS FILLING THAT ENTIRE AREA. THE ISOLATION OF THESE SECTIONS EVENTUALLY CAUSED CHANGES IN SALT CONCENTRATION OF THE MARSH WHICH LEAD TO CHANGES IN VEGETATION.

WE COULD GO ON MAKING GENERAL STATEMENTS, ABOUT THE IMPACT OF THE RAILROADS OR OTHER MAN INITIATED CHANGES ON THE MARSH WITHOUT NECESSARILY COMING TO ANY COHERENT CONCLUSIONS. BUT, IF WE THINK ABOUT THE ECOLOGICAL PRINCIPALS OUTLINED IN PART I OF THIS UNIT, WE MAY FOCUS OUR THINKING UPON ISSUES OF REAL IMPORT. THE ECOLOGICAL PRINCIPALS DEFINE THE ASPECTS OF COASTAL WETLANDS THAT PERMIT TO FUNCTION AT OPTIMAL LEVELS. THESE SAME PRINCIPALS FORM THE BASIS FOR THE COASTAL ZONE MANAGEMENT RULES WHICH ARE OUTLINED ON GUIDE SHEET 5B. READ THE LIST OF MANAGEMENT RULES AND THEN ASSESS THE IMPACT WHICH ONE OR MORE OF THE MAN INITIATED CHANGES LISTED AT THE TOP OF GUIDE SHEET 5 HAS HAD ON THE MARSH. HAS THE DEVELOPMENT OF THE MARSH BEEN CONDUCTED IN ACCORDANCE WITH THE MANAGEMENT RULES? STOP THE RECORDER WHILE YOU READ THE MANAGEMENT RULES IN SECTION B AND CARRY OUT THIE ACTIVITY IN SECTION C. WHEN YOU ARE READY TO CONTINUE, TURN THE RECORDER BACK ON.

PROPER MANAGEMENT OF COASTAL WETLANDS SHOULD BE ORGANIZED WITH THESE IMPORTANT MANAGEMENT RULES IN MIND. A SERIOUS EFFORT SHOULD BE MADE TO MAINTAIN THE STRUCTURAL, ECOLOGICAL AND AESTHETIC INTEGRITY OF THESE PRODUCTIVE AND VITAL RESOURCES.

FURTHER INSIGHT INTO THE REASONS FOR COASTAL WETLAND DESTRUCTION CAN BE GAINED BY LOOKING AT THE WAY IN WHICH SOME PEOPLE DEFINE THE VALUE OF COASTAL WETLANDS. TURN TO G.S. #6 GUIDE SHEET # 6 . . . HERE YOU HAVE TWO SETS OF STATEMENTS ON THE VALUE OF WETLANDS. TURN OFF THE RECORDER WHILE YOU READ THESE DEFINITIONS. TURN RECORDER ON AGAIN, WHEN YOU ARE FINISHED. (5 SEC MUSIC). THESE DEFINITIONS WERE LISTED IN A STATE DOCUMENT EXPLAINING THE NEED FOR PUBLIC REGULATION OF COASTAL WETLANDS. THE LIST SUMMARIZES MANY OF THE THINGS WE HAVE TALKED ABOUT IN THIS UNIT. I AM SURE YOU HAVE NOTICED THE CONTRAST BETWEEN THE COMMON DEFINITIONS AND THE UNCOMMON DEFINITIONS OF WETLAND VALUE. WHICH STATEMENTS MOST ACCURATELY RELFECT YOUR ATTITUDES WITH REGARD TO THE VALUE OF WETLANDS?

THROUGH THE EFFORTS OF SOME CONCERNED LEGISLATORS, SCIENTISTS, CONSERVATION GROUPS AND OTHERS, THE CONNECTICUT LEGISLATURE UNANIMOUSLY PASSED "AN ACT CONCERNING THE PRESERVATION OF WETLANDS AND TIDAL MARSH AND ESTUARINE SYSTEMS" IN 1969. THIS CAME TO BE KNOWN AS THE "WETLAND ACT" OR PUBLC ACT NO. 695. THE ACT GAVE THE COMMISSIONER OF ENVIRONMENTAL PROTECTION A CLEAR MANDATE TO TAKE THE STEPS NECESSARY TO PRESERVE CONNECTICUTS TIDAL MARSHES. THE ACT CLEARLY STATES THAT AN IMMEDIATE MAPPING AND INVENTORY BE MADE OF CONNECTICUT'S SALT MARSHES. THE TERM SALT MARSHES IS CAREFULLY DEFINED IN THE LAW. THERE ARE TWO MAJOR FEATURES WHICH YOU SHOULD NOTE:

1. FIRST, TO BE CONSIDERED TIDAL MARSH, THE LAND MUST BE SUBJECT TO TIDAL ACTION, OR IT MUST BE CONNECTED TO TIDAL WATERS; AND

2. SECOND, IT MUST BEAR AN ASSOCIATION OF PLANTS CHARACTERISTIC OF SALT MARSHES, OR HAVE THE CAPABILITY THEREOF.

THE DEFINITION IS BASED ON THE VEGETATION OF THE MARSH. IT MAY BE USEFUL FOR YOU TO REVIEW THE PLANT SPECIES AND DISTRIBUTION IN PART I OF THIS UNIT. THE TIDAL MARSHES OF CONNECTICUT: A PRIMER OF WETLAND PLANTS PUBLISHED BY THE CONNECTICUT COLLEGE ARBORETUM IS ALSO AN EXCELLANT RESOURCE FOR THIS PURPOSE. IT IS LISTED IN THE BIBLIOGRAPHY.

BEFORE PROCEEDING ANY FURTHER, YOU SHOULD TAKE TIME TO READ THE SUMMARY OF PUBLIC ACT 695, PRESENTED ON GUIDE SHEET # 7. TURN OFF THE RECORDER WHILE YOU STUDY GUIDE SHEET # 7. G.S. #7

BECAUSE THE LAW IS BASED ON VEGETATION, THE MAPPING REQUIRED ENGINEERS AND BIOLOGISTS TO IDENTIFY AND STAKE THE WETLAND AREAS IN THE FIELD AND THEN LOCATE THEM ON PROPERTY MAPS. THE TASK AT TIMES WAS NOT DIFFICULT SINCE COASTAL WETLAND PLANTS OCCUR IN ZONES WITH RESPECT TO MEAN TIDAL LEVELS. THE BOUNDARIES ALMOST ALWAYS CORRESPOND WITH THE ZONE HIGH TIDE BUSH AND OR SWITCH GRASS. HIGH TIDE BUSH OCCURS JUST AT THE LEVEL OF THE SEASONAL EXTREME HIGH TIDE, WHEN THE SURFACE OF THE MARSH IS INUNDATED TO A DEPTH OF ABOUT SIX INCHES. THE SWITCH GRASS ZONE CORRESPONDS WITH THE LEVEL OF OCCASIONAL STORM TIDES. THE LEGAL LANGUAGE TAKES ADVANTAGE OF PLANT ZONATION THAT WE DISCUSSED IN THE FIRST PART OF THIS UNIT. IN CASE YOU ARE INTERESTED OR MAY NEED THE INFORMATION IN THE FUTURE, A LIST OF HIGHER PLANTS WHICH FORM THE DOMINANT VEGETATION OF SALT MARSHES IS PRESENTED ON GUIDE SHEET # 8. STOP THE RECORDER AND REVIEW GUIDE SHEET # 8. WHEN YOU ARE READY TO CONTINUE, TURN THE RECORDER BACK ON! (PAUSE) G.S. #8

THE DEPARTMENT OF ENVIRONMENTAL PROTECTION HAS NEARLY COMPLETED THE PROGRAM OF INVENTORYING AND MAPPING THE BOUNDARIES OF THE STATE'S WETLANDS. MAPS DESIGNATING TIDAL WETLANDS ARE ON FILE IN EACH TOWN POSSESSING THESE AREAS WITHIN IT'S BOUNDARIES.

IN CONNECTICUT, THE PROCESS OF PROTECTING THE TIDAL MARSHES WAS A SLOW ONE. AFTER BIOLOGISTS MAPPED THE COASTAL WETLAND AREAS, THE INFORMATION WAS TRANSFERRED BY ENGINEERS TO PROPERTY LINE MAPS. OWNERS OF AFFECTED PROPERTY WERE NOTIFIED BY REGISTERED LETTER NOT LESS THAN 30 DAYS BEFORE A PUBLIC HEARING ON THE BOUNDARIES. A HEARING OFFICER TOOK TESTIMONY AT THE HEARINGS OF DISCREPANCIES, OMISSIONS, ADDITIONS AND APPEALS FOR EXCLUSIONS. AFTER THE HEARING ADJUSTMENTS OF BOUNDARIES WERE MADE BASED ON FIELD CHECKS AND THE HEARING. FINALLY, THE COMMISSIONER OF ENVIRONMENTAL PROTECTION ISSUED AN ORDER ESTABLISHING THE BOUNDARIES WHICH HAVE BEEN PUBLISHED AS A LEGAL NOTICE IN PUBLIC HEARINGS.

ONCE BOUNDARIES FOR COASTAL WETLANDS ARE LEGALLY DETERMINED, THE ACT REGULATES THE ACTIVITIES THAT CAN OCCUR WITHIN THOSE AREAS. ACTIVITIES REGULATED BY THIS ACT INCLUDE, BUT ARE NOT LIMITED TO, DRAINING, DREDGING, EXCAVATION OR REMOVAL OF SOIL, MUD, SAND OR GRAVEL FROM ANY WETLAND OR THE DUMPING, FILLING, OR DEPOSITING OF ANY SOIL, STONES, SAND, RUBBISH, AND ERECTION OF STRUCTURES, DRIVING OF PILES, OR PLACING OF OBSTRUCTIONS WHETHER OR NOT THEY CHANGE THE TIDAL EBB AND FLOW. NO REGULATED ACTIVITY MAY BE CONDUCTED IN ANY WETLAND WITHOUT A PERMIT, AND ANY PERSON PROPOSING TO CONDUCT A REGULATED ACTIVITY UPON A REGULATED WETLAND MUST FILE AN APPLICATION FOR A PERMIT WITH THE COMMISSIONER OF ENVIRONMENTAL PROTECTION. ACCORDING TO THE LANGUAGE OF THE ACT, THE COMMISSIONER IN GRANTING A PERMIT MUST CONSIDER THE EFFECT OF THE PROPOSED WORK ON PUBLIC HEALTH AND WELFARE, MARINE FISHERIES, SHELL FISHERIES, WILDLIFE, PROTECTION OF LIFE AND PROPERTY FROM FLOOD, HURRICANE AND OTHER NATURAL DISASTERS AND THE GENERAL POLICIES OF THE ENTIRE ACT.

PHILOSOPHICALLY THE LAW IS WELL DESIGNED. UNFORTUNATELY, THE DEPARTMENT OF ENVIRONMENTAL PROTECTION LACKS THE PERSONNEL TO MONITOR ACTIVITIES ON EVERY COASTAL WETLAND. AS A RESULT, CITIZEN INPUT IS EXTREMELY IMPORTANT TO COMPLETE THE SUCCESS OF THE ACT. SUSPECTED VIOLATIONS OF PUBLIC ACT 695 SHOULD BE REPORTED TO THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

ONCE PUBLIC ACT 695 BECAME LAW, IT WAS ONLY A MATTER OF TIME BEFORE THE LAW WOULD BE CHALLENGED IN THE COURTS. THE FIRST MAJOR CONTEST WAS NOT LONG IN COMING . . . SINCE 1948, THE RYKAR CORPORATION OF STRATFORD HAD BEEN BURYING PIECES OF THE GREAT MEADOWS SALT MARSH FOR FUTURE INDUSTRIAL DEVELOPMENT. THE GREAT MEADOWS SALT MARSH IS MARKED ON THE MAP OF TIDAL MARSHES ON GUIDE SHEET # 3 and is shown in slide #14. (Pause) BEFORE THE DEVELOPMENT OF THE MARSH COULD PROCEED, THE RYKAR CORPORATION HAD TO CONTEND WITH PUBLIC ACT 695. Slide #14

IN 1970, THE RYKAR INDUSTRIAL CORPORATION FILED AN APPLICATION FOR A PERMIT TO FILL IN THE GREAT MEADOWS SALT MARSH IN TWO STAGES TO CONSTRUCT A DEEPWATER PORT AND AN INDUSTRIAL PARK. THE PUBLIC HEARING ON THE PERMIT ATTRACTED WIDE ATTENTION BECAUSE IT CALLED FOR THE LOSS OF 277 ACRES OF A LARGE HEALTHY MARSH AND BECAUSE IT WAS CONSIDERED A TEST OF THE STRE-

NGTH OF PUBLIC ACT 695. RYKAR CLAIMED THAT SINCE THERE WAS NO PUBLIC ACT 695 IN 1948, THEY SHOULD BE ALLOWED TO DEVELOP THE MARSH. RYKAR CLAIMED THE LAND WAS WORTH $150,000/ACRE AS AN INDUSTRIAL SITE. IN ADDITION, THE NEW INDUSTRIAL PARK WOULD PROVIDE TAXES TO THE TOWN OF STRATFORD. IF THEY WERE NOT ALLOWED TO PROCEED, RYKAR ASSERED THAT THE STATE WOULD BE TAKING THEIR LAND WITHOUT COMPENSATION.

OPPONENTS OF THE PERMIT ASSERTED THAT THE GREAT SALT MEADOWS MARSH WAS A HEALTHY VITAL PRODUCTIVE WETLAND THAT WOULD BE DESTROYED BY FILLING. THEY CLAIMED THIS WAS JUST THE ACTIVITY THAT PUBLIC ACT NO. 695 WAS PASSED TO PREVENT. TO SUPPORT THEIR ASSERTION THAT THIS PERMIT SHOULD BE DENIED, THEY PRESENTED TESTIMONY ON THE CONSEQUENCES OF THE DESTRUCTION OF THIS MARSH. AMONG THE EFFECTS WOULD BE THE DESTRUCTION OF THE OYSTER BEDS, POSSIBLE EROSION BY TIDES OF RECREATIONAL BEACHES, AND THE LOSS OF A LARGE AREA WHICH ENTRAPPED SEDIMENTS FROM UPLAND EROSION. WHEN THERE IS NO MARSH, THE SEDIMENTS RUN INTO THE SEA, FILLING IN HARBORS AND CHANNELS.

THE CLIMAX OF THE HEARING WAS PROVIDED BY EDWIN COFFIN, REPRESENTING THE ARMY CORPS OF ENGINEERS, WHO TESTIFIED THAT IF THE MARSH WAS FILLED IN, THE RAIN RUN OFF AND ITS BURDEN OF SEDIMENT, COULD NOT BE DRAINED FROM THE FILLED-IN AREA INTO THE SOUND, WITHOUT COMPLEX ENGINEERING, THE COST OF WHICH WOULD HAVE TO BE MET BY THE FEDERAL AND LOCAL GOVERNMENT. TO REPLACE THE MARSH, STRATFORD WOULD NEED A HURRICANE BARRIER, A DIKE 12 FEET WIDE AND 18 FEET HIGH TO PROTECT THE TOWN FROM HURRICANES. OF THE 14 MILLION DOLLAR COST, $3.5 MILLION WOULD COME FROM STRATFORD TAXES.

IN FEBRUARY 1971 THE COMMISSIONER OF ENVIRONMENTAL PROTECTION DENIED A PERMIT TO RYKAR. FOLLOWING THE DENIAL, RYKAR SUED THE STATE OF CONNECTICUT CLAIMING AN UNJUST TAKING OF THEIR LAND HAD OCCURRED. THEY REQUESTED JUST COMPENSATION ON AN ASSERTED VALUE OF $150,000 PER ACRE OR 42 MILLION DOLLARS.

THE LAND USE CONTROLS PLACED UPON PRIVATE LAND OWNERS UNDER THIS AND OTHER LAND USE PLANNING ACTS IS A CONSTANT SOURCE OF CONTROVERSY. SIGNIFICANT DISCUSSION HAS OCCURED ON THE DISTINCTION BETWEEN PUBLIC AND PRIVATE RIGHTS IN PROPERTY. THE QUESTION OF WHAT KIND OF PUBLIC CONTROL OF PRIVATE PROPERTY CONSTITUTES A TAKING OF AN INDIVIDUALS LAND WITHOUT JUST COMPENSATION IS THE SOURCE OF CONTINUING LITIGATION.

IN DECEMBER 1973 THE SUPERIOR COURT IN HARTFORD, IN A COMPLEX DECISION UPHELD THE PERMIT DENIAL BUT OFFERED RYKAR THE HOPE THAT A REVISED APPLICATION MIGHT BE ACCEPTABLE. THE CASE IS UNDER FURTHER LITIGATION. THE COURT OF COMMON PLEAS IN ANOTHER RECENT DECISION INVOLVING THE WETLAND ACT STATED THAT "THE LEGISLATION IS ESTABLISHING THE POLICY OF PROTECTION FOR TIDAL WETLANDS BASED ON THE POWER OF THE STATE TO PROMOTE THE PUBLIC HEALTH AND WELFARE, RECOGNIZED THAT IT MUST BE BALANCED AGAINST THE COMMON LAW RIGHT TO FREE USE OF PROPERTY . . ."

THE COURT ALSO CONCURRED THAT A LAND OWNER SHOULD BE ENTITLED TO SOME FEASIBLE AND PRACTICAL USE OF HIS PROPERTY. ALTHOUGH SPECIFIC EXERCISE OF POLICE POWER DOES PREVENT THE ENJOYMENT OF CERTAIN OF THE LANDOWNER'S RIGHTS THIS DOES NOT NECESSARILY CONSTITUTE A TAKING WITHOUT JUST COMPENSATION.

A MORE RECENT CASE HAS JUST BEEN REVIEWED BY THE CONNECTICUT STATE SUPREME COURT. AN ARTICLE, FROM THE D. E. P. CITIZEN BULLETIN IS A REPRODUCED GUIDE SHEET # 9 . THE ARTICLE DESCRIBES THE BRECCIAROLI CASE FOR YOU. STOP THE RECORDER WHILE YOU READ GUIDE SHEET # 9 . G.S. #9

IN ARGUING FOR THE DEVELOPMENT OF COASTAL WETLANDS EMPHASIS IS GENERALLY PLACED ON THE VALUE OF THE LAND IN QUESTION, AND THE INCOME AND TAX REVENUES TO BE GENERATED BY THE ACTIVITY PROPOSED FOR THE WETLAND. FREQUENTLY THE OWNERS OF THE COASTAL WETLANDS AND PROPONENTS OF WETLANDS DEVELOPMENT FAIL TO RECOGNIZE THE LONG TERM COST OF DEVELOPING THESE AREAS. THE DEVELOPMENT OF WELANDS IS MARGINALLY FEASIBLE AT BEST! THE INITIAL COST OF DEVLOPMENT OR SITE PREPARATION, WHEN COMBINED WITH THE LONG-RANGE COST OF MAINTENANCE AND PROTECTION THAT THESE AREAS USUALLY REQUIRE, RAISES THE COST BEYOND A REASONABLE LEVEL. COASTAL WETLANDS MUST BE DRASTICALLY ALTERED BEFORE ANY TYPE OF PERMANENT STRUCTURE MAY BE LOCATED ON THEM. THE TEMPTATION TO DEVELOP THESE AREAS WILL CONTINUE TO EXIST SINCE THE INITIAL PRICE OF THE WETLANDS IS LOW COMPARED TO THE ADJACENT UPLAND AND THE POTENTIAL FOR A QUICK RETURN IS HIGH.

THE EXTENSIVE ALTERATION WE REFER TO WOULD INCLUDE LARGE-SCALE FILLING AND DREDGING OPERATIONS THAT WILL RESULT IN A NUMBER OF LIABILITIES THAT OFTEN OUTWEIGH THE ADDITION TO THE TAX BASE OF THE COMMUNITY THAT THE DEVELOPMENT WOULD ADD. SOME OF THESE LIABILITIES ARE LISTED ON GUIDE SHEET #10.

1) FLOODING in coastal WETLANDS OFTEN OCCURS AS A RESULT OF A SET OF CONDITIONS INCLUDING THE SUPERPOSITION OF ABNORMALLY HIGH TIDES, STORM SURGE, SEASONAL STORMS, AND HURRICANES. SUCH FLOODING CAUSES A HIGH LEVEL OF EROSION OF THE EXPOSED FACES OF LAND. IF THE MARSH IS FILLED, IT WILL BE NECESSARY TO INSTALL PROTECTIVE STRUCTURES TO ALLEVIATE THIS PROBLEM, BUT THE STRUCTURES THEMSELVES OFTEN CAUSE ADDITIONAL PROBLEMS ELSEWHERE. IN ADDITION, MAINTENANCE OF ROADS AND UTILITY LINES THROUGH AREAS THAT ARE SUBJECT TO FLOODING IS QUITE OFTEN A CONTINUOUS PROCEDURE, ESPECIALLY DURING THE FALL AND WINTER SEASONS. G.S. #10

2) SOIL CONDITIONS IN MARSH AREAS NECESSITATE THE USE OF FILLED AREAS FOR THE

PLACEMENT OF SEPTIC SYSTEMS AND THE ATTENDANT LEACHING FIELDS. THESE SYSTEMS ARE SELDOM CAPABLE OF HANDLING THE VOLUME AND VARIETY OF TODAY'S SEWAGE, ESPECIALLY WHEN THE LAND USE IS CONCENTRATED. THE DEVELOPMENT OF WETLANDS WILL HASTEN THE TIME WHEN A COMMUNITY MUST INSTALL OR EXPAND A MUNICIPAL SEWER SYSTEM, NECESSITATING THE EXPENDITURE OF LARGE SUMS OF MONEY FOR THE TREATMENT PLANT AND THE ATTENDANT COLLECTION LINES AND PUMPING STATIONS. THE TIME SCALE INVOLVED IN THE INSTALLATION AND EXPANSION OF THIS SYSTEM WILL BE RELIANT ON THE SUITABILITY OF ANY LAND FORM TO DEVELOPMENT ALONG WITH THE CONCENTRATION OF THE DEVELOPMENT ITSELF.

3) GROUNDWATER SERVES AS THE WATER SUPPLY OF MOST COASTAL COMMUNITIES AND SOME PROBLEMS INVOLVED IN THE PROPER UTILIZATION OF THIS RESOURCE CAN BE READILY LINKED TO SEWAGE DISPOSAL. PRIVATE WELL SYSTEMS ARE OFTEN PLAGUED BY SALTWATER INTRUSION AND INEFFECTIVE SEPTIC SYSTEMS, ESPECIALLY IN OR ADJACENT TO WETLAND AREAS. THESE PROBLEMS NECESSITATE THE EXTENSION OF A MUNICIPAL WATER SUPPLY SYSTEM INTO AREAS PREVIOUSLY SUPPLIED PRIVATELY. MUNICIPAL SYSTEMS SUCH AS THOSE WE HAVE MENTIONED REQUIRE THE OUTLAY OF LARGE SUMS OF MONEY, OFTEN BEFORE THE COMMUNITY IS REALISTICALLY PREPARED TO MAKE SUCH A FINANCIAL COMMITTMENT.

ENVIRONMENTAL QUALITY AND LONG-RANGE ECONOMIC WELFARE GO HAND-IN-HAND IN THE COASTAL COMMUNITY. IT IS THE COASTAL RESOURCES THAT ATTRACT VISITORS AND POTENTIAL HOMEOWNERS TO THESE AREAS. THE DEGRADATION OF ANY UNIQUE LAND FORM OR THE UNEDUCATED USE OF ANY ECOLOGICALLY VALUABLE AREA WILL ULTIMATELY RESULT IN BOTH THE LOSS OF THE VIABLE AREA AND THE ULTIMATE DECLINE OF THE COMMUNITY. THE STATE AND FEDERAL GOVERNMENT CAN INSTITUTE WETLAND PROTECTION THROUGH LEGISLATIVE ACTION, BUT IT IS UP TO THE COMMUNITY AND ITS CITIZENS TO COMPLY WITH THESE REGULATIONS AND TO WORK TOWARDS ASSURING THE VIABILITY OF THE COASTAL RESOURCES.

BY NOW, IT IS OBVIOUS THAT FOR A LARGE VARIETY OF REASONS, BY EXERCISING HIS RIGHTS OF OWNERSHIP, MAN HAS HAD A NEGATIVE IMPACT UPON COASTAL WETLANDS. MANY CONFLICTS HAVE ARISEN OVER THE VALUE OF COASTAL WETLANDS AND PATTERNS OF THEIR UTILIZATION. ON GUIDE SHEET #10 THERE IS AN ACTIVITY WHICH ASKS YOU TO LIST THE KINDS OF THINGS THAT COASTAL WETLAND OWNERS HAVE DONE TO ALTER THESE AREAS. TURN OFF THE RECORDER WHILE YOU CARRY OUT THE ACTIVITY ON GUIDE SHEET #10. G.S. #10

WELL, I HAVE A FEELING THAT YOU HAVE PROBABLY GENERATED A RELATIVELY LONG LIST... NOW LET'S SEE HOW SOME OF THE ACTIVITIES YOU LISTED HAVE ACTUALLY ALTERED AND POLLUTED ESTUARIES IN THE COASTAL ZONE. TURN TO GUIDE SHEET #12... THERE YOU HAVE A LIST OF USES OF ESTUARIES AND THE TYPES OF ALTERATION AND POLLUTION THESE LAND USES HAVE BROUGHT ABOUT. TURN OFF THE RECORDER WHILE YOU STUDY GUIDE SHEET #12. G.S. #12

SINCE 1969, SEVERAL PROGRAMS DEALING WITH TIDAL WETLANDS HAVE COME INTO BEING THAT COMPLEMENT THE TIDAL WETLANDS ACT.

THE COASTAL MANAGEMENT ACT, PASSED BY THE UNITED STATES CONGRESS IN 1972, TAKES NOTE OF THE IMPORTANCE AND FRAGILITY OF COASTAL ZONE AREAS AND THE MANY COMPETING USES IN THESE AREAS. THE ACT RECOGNIZES MANY OF THE INADEQUACIES IN COASTAL ZONE PLANNING AT THE STATE LEVEL. THROUGH PLANNING GRANTS, THE LEGISLATION ENCOURAGES THE STATES TO TAKE ADEQUATE STEPS TO PROTECT COASTAL LAND AND WATER RESOURCES. THE BASIC THRUST OF THE LEGISLATION IS TO ENCOURAGE COMPREHENSIVE PLANNING AND MANAGEMENT, AS OPPOSED TO EFFORTS DESIGNED ONLY TO COUNTER SPECIAL PROBLEMS SUCH AS WETLANDS PROTECTION.

PLANNING REQUIRES A SYSTEM OF IDENTIFICATION AND CLASSIFICATION OF GENERAL AREAS OF ENVIRONMENTAL CONCERN. SUCH AREAS ARE IDENTIFIED AS THOSE WHERE UNCONTROLLED DEVELOPMENT MIGHT LEAD TO SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACT.

AT THE UNITED STATES SENATE HEARING ON THE COASTAL ZONE MANAGEMENT ACT THREE CAPABILITY DESIGNATIONS WERE STIPULATED FOR PLANNING PURPOSES. THESE THREE DESIGNATIONS ARE...LISTED AT THE BOTTOM OF GUIDE SHEET #12. G.S. #12

1. VITAL AREAS OF PRESERVATION AREAS: ECOSYSTEM ELEMENTS OF SUCH CRITICAL IMPORTANCE AND VALUE THAT THEY ARE TO BE PRESERVED INTACT AND PROTECTED FROM HARMFUL OUTISDE FORCES - ENCOMPASSED WITHIN AN AREA OF ENVIRONMENTAL CONCERN.

2. AREAS OF ENVIRONMENTAL CONCERN OR CONSERVATION AREAS: BROAD AREAS OF ENVIRONMENTAL SENSITIVITY, OFTEN CONTAINING ONE OR MORE VITAL AREAS, THE DEVELOPMENT OR USE OF WHICH MUST BE CAREFULLY CONTROLLED TO PROTECT THE ECOSYSTEM.

3. AREAS OF NORMAL CONCERN OR UTILIZATION AREAS: AREAS WHERE ONLY THE NORMAL LEVELS OF CAUTION ARE REQUIRED IN UTILIZATION AND IN DEVELOPMENT ACTIVITY.

IDENTIFYING WETLAND AREAS AND CATEGORIZING THEN FOR PLANNING PURPOSES IS JUST A BEGINNING. THERE ARE MANY AGENCIES WHICH HAVE JURISDICTIONAL POWERS IN THE COASTAL ZONE. GUIDE SHEET #13 SUMMARIZES THE STATE AGENCIES WHICH HAVE AN INVOLVEMENT IN THE COASTAL ZONE. TURN OFF THE RECORDER WHILE YOU STUDY GUIDE SHEET #13. G.S. #13

IN IMPLEMENTING THE COASTAL MANAGEMENT ACT, STATES MUST DETERMINE WHAT ROLE THEY WILL PLAY RELATIVE TO LOCAL GOVERNMENT. DETERMINATIONS MUST BE MADE AS TO WHERE THE INLAND BOUNDARIES DEFINING THE REGULATED COASTAL ZONE SHALL BE SET. IN ADDITION TO JURISDICTIONAL QUESTIONS, STATES WILL ALSO HAVE TO RESOLVE MANAGEMENT PROBLEMS SUCH AS ADEQUATE ASSESSMENT OF CHOICES, SOUND DECISIONS ON LAND USE PRIORITIES, PUBLIC PARTICIPATION, PUBLIC ACCESS TO BEACHES, MONITORING AND ENFORCEMENT. ONLY TIME

AND PERFORMANCE WILL TELL THE FATE OF THE COASTAL ZONE MANAGEMENT CONCEPT.

IN 1974, CONNECTICUT RECEIVED ITS FIRST COASTAL ZONE PLANNING GRANT. THE PROPOSAL STATES THAT THE OVERALL GOAL OF THE COASTAL ZONE MANAGEMENT PROGRAM IS PROTECTION, PRESERVATION AND RESTORATION, AS WELL AS DESIREABLE ECONOMIC UTILIZATION OF CONNECTICUT'S COASTAL RESOURCES. THESE ARE ADMIRABLE GOALS. AS THE PROGRAM IS IN ITS FORMATIVE STAGES, IT IS TOO EARLY TO REACH ANY CONCLUSIONS ABOUT ITS POTENTIAL SUCCESS. A STATEMENT OF OBJECTIVES FOR CONNECTICUT'S COASTAL ZONE PROGRAM ARE OUTLINED ON GUIDE SHEET #14. G.S.#14

A SERIES OF STATEMENTS ON THE PROBLEMS AND ISSUES INVOLVED IN THE CONNECTICUT COASTAL ZONE MANAGEMENT PROGRAM ARE PRESENTED ON GUIDE SHEET #15. STOP THE RECORDER AND STUDY GUIDE SHEETS #14 AND #15. G.S.#15

THE COASTAL ZONE OF THE ENTIRE LONG ISLAND SOUND AREA HAS BEEN THE FOCUS OF ANOTHER PLANNING PROGRAM FUNDED THROUGH THE NEW ENGLAND RIVER BASINS COMMISSION BETWEEN 1971 AND 1975. THE FINAL REPORT OF THE LONG ISLAND SOUND STUDY IS CONCERNED WITH MANY OF THE TOPICS OF THE LAND USE DECISION MAKING KIT. IT SUMMARIZES MANY OF THE PROBLEMS AND POSSIBLE SOLUTIONS OF THE COASTAL ZONE ON LONG ISLAND SOUND. TOPICS INCLUDED IN THE REPORT ARE WATER POLLUTION CONTROL MEASURES, DREDGING AND SOILS DISPOSAL, WATER SUPPLY, FISHING, WILDLIFE, LAND USE, RECREATION, WETLANDS, ENERGY FACILITIES SITING, NATURAL FORCES, HARBORS, POPULATION, ECONOMIC GROWTH, AS WELL AS A LONG LIST OF POSSIBLE SOLUTIONS. WHILE THE REPORT IS A DISCUSSION STIMULANT, IT DOES NOT SUGGEST PRIORITIES, PERFORMANCE STANDARDS OR SOURCES OF FUNDING FOR THE PROGRAM SUGGESTIONS. A COPY OF THE REPORT, PEOPLE AND THE SOUND IS INCLUDED IN THE KIT.

FOR COASTAL ZONE PLANNING TO BE EFFECTIVE, IT MUST BE COMPREHENSIVE AND INTEGRATED. PLANS MUST BE FOLLOWED BY SOUND MANAGEMENT AND ENFORCEMENT BY STATE AND LOCAL AGENCIES. EVEN THE FINEST PLANS WILL NOT BE SUCCESSFUL WITHOUT YOUR SUPPORT. THROUGH ACTIVE PARTICIPATION IN THE DECISION MAKING PROCESS, PLANS CAN BE ADJUSTED TO MEET YOUR DESIRES AND NEEDS AS WELL AS THOSE OF YOUR COMMUNITY. PLANS WITH WIDE SPREAD SUPPORT STAND A MUCH BETTER CHANCE OF BEING EFFECTIVELY IMPLEMENTED THAN PLANS WHICH ARE MANDATED BY AN AGENCY OR TOWN COMMISSION.

TO COMPLETE THIS UNIT, REVIEW SECTIONS OF PEOPLE AND THE SOUND THAT ARE OF PARTICULAR INTEREST TO YOU. PAY PARTICULARLY CLOSE ATTENTION TO PAGES 20 TO 24 OF THE REPORT. ON THESE PAGES YOU WILL FIND SPECIFIC RECOMMENDATIONS FOR MANAGING THE COASTAL ZONE. IT MIGHT BE INTERESTING TO COMPARE THE RECOMMENDATIONS FOR MANAGEMENT OF THE COASTAL ZONE IN PEOPLE AND THE SOUND WITH THE MANAGEMENT PRINCIPLES ON GUIDE SHEET #16 DEVELOPED BY JOHN CLARK OF THE CONSERVATION FOUNDATION. G.S.#16

THIS ACTIVITY CLOSES THE UNIT ON COASTAL WETLANDS. WE HOPE THAT YOU WILL FIND THE INFORMATION IN THE UNIT TO BE OF VALUE TO YOU AND YOUR COMMUNITY.